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INTRODUCTION

This report contains a summary of results obtained by the Crops and Soils Department of the Louisiana Agricultural Experiment Station during the years 1926-1936. Some of the experiments were run but a short time. Results from such experiments must be taken as tentative only. The discussions give, in brief, data on a part of the various subjects about which information is sought from the department by farmers of the State. While the discussions are not long, it is believed that they may be of some aid in giving easily available information to the busy farmer. References are given to other bulletins that may be read if more detailed information is sought.

In addition to the work mentioned in the following discussion, research men of the department have carried on some technical work on rice and sugar cane, and some co-operative work on rice, sugar cane, and pastures. Since this work has been or will be reported elsewhere, no further mention of it will be made here.

PART I

H. B. Brown, J. R. Cotton,* and D. C. Neal†

COTTON

The cotton work of the Department has dealt with the adaptation of varieties of cotton to various parts of the State, genetics studies, the breeding of better varieties for Louisiana, disease control by seed treatment, boll weevil control, certain phases of cotton culture, and cotton fiber studies.

Cotton Varieties for Louisiana. During the past ten years, 142 different cotton variety tests have been conducted in different parts of Louisiana in an effort to determine the best varieties in the various sections. It has been found that on the average, the annual monetary return from well adapted varieties is about $25.00 more per acre than from the poorly adapted varieties. The tests that have been conducted give a good indication of the value of varieties for different localities. From these studies and from general observations of crops grown, it appears that cottons of a vigorous type, such as D&PL 4-8, are best for the less fertile hill lands of northern Louisiana. A somewhat more prolific type such as D&PL 10, Stoneville-3 or 5, or Deltapine (D&PL 11) will be better for the richer hill lands and the small valleys of the region just mentioned. If many plants grown on the land die with the cotton wilt disease, it will pay to plant a wilt resistant variety. Dixie Triumph has yielded better than any other wilt resistant variety planted in the State. All of the varieties mentioned have a fair to good gin turnout and a satisfactory staple length.

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In the prairie district of southwestern Louisiana, the varietal adaptations are about the same as in the region just mentioned; that is, D&PL 4-8 type for the poorer lands and Stoneville, Deltapine, and D&PL 10 for the richer ones. If the grower wants a long staple cotton, Delfos-531, Delfos-2323-978, or Delfos-5555 (Missdel-4) are probably the best.

In the richer delta and alluvial lands of the State, especially on the Mississippi and Red river alluvial lands, varieties of the Delfos type have in general given the best returns. On less fertile alluvial lands, Stoneville, Deltapine, and D&PL 10 have done well. If the farmer wishes to grow a long staple cotton on land that is badly infected with cotton wilt, he should plant Express-317 or Express-121 (Delpress). If he wants to grow a cotton with staple still longer than that of any of the varieties mentioned, Wilds is probably the best.

The Experiment Station tests have shown that Mebane Triumph, Lone Star, Kasch, Lankart, Texas Rowden, Acala-8, Qualla, and other of the Texas Big Boll varieties are poor producers in Louisiana.

Table I gives the main characteristics of ten of the leading varieties grown in the State. The figures given are averages, for a five-year period, of crops grown on alluvial land at Baton Rouge, Louisiana. Stoneville-5 and Deltapine are both excellent varieties but it is not fair to compare their yields with the yields of varieties in tests for a longer time. Production varies in different years.

TABLE I. CHARACTERISTICS OF TEN LEADING COTTON VARIETIES

Variety	*Lint per Acre*	*Lint per cent.*	*Lint Length*	*Bolls per Pound*	*Value of Lint and Seed*
Wilds	356.4	30.1	1 1/4	61	66.77
Stoneville—3	613.6	34.3	1 1/32	73	90.41
Stoneville—5*	691.0	35.1	1 1/32	72	119.49
Delfos—531	577.8	33.4	1 1/8	71	89.85
Delfos—2323-978	554.2	31.3	1 1/8	75	87.75
Missdel—3	414.8	31.4	1 1/8	63	65.85
Deltapine†	628.0	38.8	1 1/16	71	95.60
D&PL—10	592.2	34.6	1 1/32	71	86.64
Dixie Triumph	508.5	32.8	31/22	72	72.27
Express—317	518.2	33.0	1 1/8	72	81.06

*Three-year average.
†Four-year average.

(Further information about cotton varieties and other work conducted by the Crops and Soils Department may be had from the Preliminary Report issued each year.)

Practical Cotton Breeding. In the practical cotton breeding work, an effort is being made to develop better varieties for each of three main soil regions of the State. Some gains have been made but no outstanding results have yet been secured. When good varieties exist already, it is not an easy task to produce better ones. However, some progress has been made. A strain known as D&PL 8-829 seems to be some improvement over the parent strain D&PL 4-8, for North Louisiana conditions. It is more uniform, has a better picking boll, and on a six-year average shows slightly better production, higher lint percentage, and slightly better staple length.

FIGURE 1. EXPERIMENTAL PLOTS OF COTTON AND CORN. DATE OF PLANTING CORN PLOTS IN THE BACKGROUND.

At the Northeast Louisiana Station at St. Joseph, the work has been on Delfos and Express varieties. Two good strains of Delfos, 2323-978 and 2323-130, have been developed. The first strain made more than 20 bales of cotton on 8 acres in 1936. The second is very prolific and dwarfish in type. It is probably the best Delfos strain in existence for rich land.

At Baton Rouge the principal breeding work has been on Dixie Triumph, Stoneville, and hybrid strains. An effort has been made to increase the length and uniformity of the staple of Dixie Triumph. Considerable progress has been made but there is still room for further improvement. One of our strains of Dixie Triumph was chosen by the U. S. Department of Agriculture to put in the National Regional Cotton Variety Test. Some of the hybrid strains on hand at present and other new selection strains show much promise, but it will require further time to determine their merits fully. One of the new hybrid strains ranked second in the State tests in 1936 and has ranked high consistently for three years. Some of the new strains of Stoneville are good cottons but no definite improvement over the original strains.

Okra-leaf Cotton. Plants with very deeply-lobed leaves that resemble the leaves of okra plants to some degree (the leaf lobes of Okra-leaf cotton are slenderer) are occasionally found in cotton fields. (See Figure 2.) We have records of them in 25 different varieties. They are apparently caused by a mutation and breed true if grown in isolation.

In 1928 an okra-leaf plant was found in a field of Delfos cotton on the Experiment Station farm. It was prolific and had such light foliage that it was thought that a strain developed from it might be well adapted to rich bottom lands where the plants become very large, and where the heavy growth of leaves on the broad-leaf plants makes so much shade that boll weevils multiply undisturbed by the sun's rays and boll rots are prevalent. The Okra-leaf strain mentioned was purified, increased, and planted in comparison with some of the better broad-leaf varieties. Bloom counts made in the test showed that the Okra-leaf strain bloomed 50 per cent more than any other variety in the test, but the shedding rate of small bolls was unusually heavy. In a test of 20 varieties the Okra-leaf strain ranked nineteenth, eleventh, and sixteenth in production in consecutive years. Boll counts showed fewer rotten bolls on the Okra-leaf plants. The test was not conducted in such a way that comparative weevil resistance could be determined.

Crosses were made between the pure Okra-leaf strain and several of our best varieties to see if the better characters of the latter could be combined with the light foliage character of the Okra-leaf. In 1935 and 1936, several strains developed from such crosses were tested in comparison with the pure Okra-leaf strain but were found to be but slight improvements insofar as yields were concerned. The foliage on the Okra-leaf cotton is so light that apparently there is not enough leaf area to elaborate foods enough to support a large crop of developing bolls. The light foliage is also a hindrance in that the ground is not shaded enough to prevent rank growth of grass and weeds in the cotton after it is laid by.

FIGURE 2. ROW OF OKRA-LEAF COTTON (RIGHT-CENTER) AND BROAD-LEAF ROWS.

Round-leaf Cotton. An interesting new variety of cotton has been produced in the breeding plots of the Experiment Station at Baton Rouge. This strain originated from a single stalk selection made in 1930 in an increase block of Express-317.

While this variety is of slight commercial value, it is immensely interesting from a genetic standpoint. The breeding results of an outstanding strain of this kind may throw much light on the results to be expected from less evident but more valuable characters in breeding for commercial improvement.

This variety has many features not found in normal cotton. Leaves are rounded, crinkled, and somewhat thicker than the normal. Plants are dwarfish, stocky, and more bushy. Vegetative branches are distributed along the main stem rather than near the base of the stalk as is common in normal cotton. Flowers are small and flower bracts of odd shapes, mostly lanceolate and entire. Bolls are small and rounded at the point. Lint is shorter than is found in the parent strain, Express-317, and the percentage is lower.

In crosses between Round-leaf and Normal-leaf cotton, the F_2 generation showed a ratio closely approaching 1 to 3; i.e., 1 Round-leaf and 3 Normal-leaf plants. In crosses with Okra-leaf cotton, 6 different types appeared in the F_2 generation, which closely approximated the following ratio: 1 Round-leaf, 3 Normal-leaf (which was not expected), 3 Okra-leaf, 6 intermediate between Okra-leaf and Normal-leaf, 1 intermediate between Okra-leaf and Round-leaf, and 2 showing intermediate Round-leaf, Normal-leaf, and Okra-leaf. The intermediate Okra-Round type proved to be a new strain which breeds true.

Other outstanding features were found in this variety. One or more plants each year have produced sporting branches with normal leaves; however, the seed from these branches, kept pure, produce only Round-leaf plants. In 1936 one of the Okra-Round-leaf plants produced a sporting branch bearing leaves of the Okra-leaf type.

Further study is being made on the breeding of this variety and a detailed account of results will be published at a later date.

Effect of Inbreeding Cotton. In 1928, a rather extensive experiment was started to find out whether inbreeding reduces the vigor and production of cotton plants as it does corn and some other plants. If inbreeding does not reduce vigor, it can be used as a tool to purify strains and to make them more uniform. The experiment was started with eight varieties illustrating different varietal types. The first year a test was made, all of the strains that were crossed within the variety made more cotton than the selfed strains, the average increase being 16.1 per cent. The next three years, there seemed to be very little difference between the two strains but the crossed strains were slightly ahead in yields every year except one. During the last four years the crossed strains have led in production consistently. The lead in 1935 was 18.6 per cent. Crossing also increased boll size and rate of blooming. Since it was necessary to hand-pollinate flowers for all the seed used in planting, it was not feasible to have large numbers of plants each year. This may have affected results some years and made conclusions uncertain. It now seems fairly evident, however, that the inbreeding does reduce production to a limited extent, and it also seems to reduce boll size, rate of blooming, and vegetative growth early in the season. Later in the season, plants with fewer bolls make greater vegetative growth. The effect of inbreeding on lint length, on lint percentage, and on some other characters was also studied but no certain effect could be determined.

Effect of Fertilizers on Earliness. The object of this experiment was to see what effect the common fertilizer ingredients would have on earliness in cotton when used under field conditions. For five years, during the main blooming period, daily bloom counts were made on 28 plats in the general fertilizer experiment. This experiment was located on Lintonia silt loam soil at Baton Rouge. The treatment of the different plats, the average blooming rate, and the average yields for the whole period are shown in Table II.

TABLE II. EFFECT OF FERTILIZERS ON EARLINESS OF COTTON

Fertilizer Treatment	*Blooms First Week*	*Blooms Second Week*	*Blooms Third Week*	*Blooms Fourth Week*	*Blooms Fifth Week*	*Yields Seed Cotton*	*Percentage First Picking*
No phosphorus	714	1589	1479	1911	1921	66.8%	47
Total blooms to date	....	2305	3782	5693	7614	....	....
High phosphorus	1228	2561	1854	1953	1682	74.3	65
Total blooms to date	....	3789	5643	7596	9278	....	..
No nitrogen	741	1534	1340	1461	1385	55.2	59
Total blooms to date	....	2275	3615	5076	6461	....	..
High nitrogen	956	1904	1542	1630	1697	76.4	54
Total blooms to date	....	2860	4402	6032	7729	....	..
No potash	929	1764	1594	1771	1563	65.8	59
Total blooms to date	....	2693	4287	6058	7621	....	..
High potash	864	1944	1575	1894	1652	82.2	53
Total blooms to date	....	2808	4383	6277	7929	....	..
No fertilizer	590	1371	1216	1468	1322	47.4	52
Total blooms to date	....	1961	3177	4645	5967	....	..

It will be observed that the high application of phosphorus fertilizer increased the blooming rate for the first four weeks and gave the highest percentage of yield at the first picking but not the highest total yield.

The high nitrogen application increased the blooming rate over no-nitrogen throughout the whole period and increased total yields. Nitrogen is the fertilizer most needed on this soil. The percentage of cotton the first picking was higher on the no-nitrogen plats than on the high-nitrogen due to the fact that the less vigorous plants stopped fruiting sooner.

The high application of potash reduced the blooming rate the first week, compared with the no-potash, but the total blooming and yield of cotton were increased. Potash is badly needed on this land.

The no-fertilizer plats, as was to be expected, had the lowest blooming rate and made lowest yields.

From the results of this experiment, it appears that phosphorus does increase earliness to some degree and potash decreases it, but the decrease may be more than balanced by the benefit shown later in increased growth and production.

Effect of X-rays on Cotton. Within the last few years a number of investigators have used X-rays on plants in an effort to produce mutations. Killough and Horlacher of Texas were the first to experiment with the effect of X-rays on cotton. They obtained some interesting results but no mutations of any economic importance.

In 1933, C. B. Roark, a graduate student in the Agronomy Department at Louisiana State University, tried the use of X-rays on cotton seed, both dry and soaked, and on flower buds. The length of treatment was varied from a few minutes to several hours. Soaked seed that were treated for an hour or more failed to germinate. The germination of the treated seed was lower than the untreated checks in nearly all cases. Plants grown from the treated seed were all somewhat abnormal and smaller than the check plants. Both the second generation plants grown from selfed seed produced on the plants that were grown from treated seed, and second generation plants grown from seed from rayed flower buds, showed more variation than the untreated lines that were used as checks. Unfortunately it was not possible to study these plants in detail nor to grow them in later generations. Nothing of economic importance appeared.

Cotton Seed Treatment. Within recent months there has been considerable interest in seed treatment to improve germination, to aid in the control of seedling diseases, and to facilitate more uniform planting. Unfortunately, a part of this interest is due to propaganda put out by companies that wish to profit by delinting the seed, or to sell material to use in treating the seed, or to sell new planters made to plant the delinted seed. The Crops and Soils Department conducted delinting experiments two different years. Each year several thousand seeds, both delinted and undelinted, were counted out and planted. Five different varieties or strains were used. In two cases, the normal seeds gave the highest germination and in three cases, the delinted, but the differences in rate were not great. The results for 1928 are shown in Table III.

TABLE III. EFFECT OF SEED TREATMENT ON GERMINATION

Variety		*Number Plants merged*	*% Germination*
822x65–42	3500 delinted seed planted	904	25.8
822x65–42	3500 regular seed planted	957	27.3
822x65–41	3000 delinted seed planted	944	31.4
822x65–41	3000 regular seed planted	654	21.8
41–311	3000 delinted seed planted	1203	40.0
41–311	3000 regular seed planted	986	32.8

The resultant stands on all plats were sufficient to give all the plants needed when the cotton was chopped out. There was no significant difference in yield of seed cotton when the cotton was picked.

In 1931 and in 1932 limited tests were made on the effect of Ceresan on seed germination and on the control of disease in young plants. Both years the germination was slightly better where the seed had been treated and fewer seedlings were diseased. In 1931, six per cent of the plants from treated seed and 14 per cent from the untreated seeds were diseased. The stands were good on both sets of plats, however, and at harvest the untreated plats yielded 127.0 pounds of seed cotton and the treated 123.8 pounds, an insignificant difference.

In 1935 and 1936, Dr. D. C. Neal, of the U. S. Department of Agriculture, carried on seed treatment experiments in co-operation with the Experiment Station. Results for 1936 are shown in Table IV.

Table IV. Further Studies with Seed Treatment

Treatment—4 oz. dust per bu. seed.	*Average per cent Emergence*	*Yield Seed Cotton per Acre, Pounds*
Ceresan	69.2	1387
Improved Ceresan	43.2	1475
Sulphuric acid delinted	41.0	1238
Sulphuric acid delinted plus Ceresan	47.7	1188
Red Copper Oxide	38.6	1525
Metiox	39.1	1575
Untreated	34.4	1363
Treatment—2 oz. dust per bu. seed		
Ceresan	49.8	1225
Improved Ceresan	48.7	1250
Red Copper Oxide	36.6	1175
Untreated	32.9	1063

Boll Weevil Control. On account of the mild winters, frequent summer rains, and the rank growth of cotton plants, boll weevils are more difficult to control in South Louisiana than in most other parts of the Cotton Belt. In fact, the difficulty is so great that farmers here have largely abandoned cotton as a crop. The Crops and Soils Department has carried on no regular boll weevil control experiments, but it has been necessary to do a good deal of boll weevil control work in order to protect cotton in other experiments. A brief mention of methods used may be of some aid to farmers who wish to grow cotton under conditions that prevail in South Louisiana.

Many weevils that have survived the winter are always present in the cotton before squares are large enough to puncture. A thorough pre-square poisoning with calcium arsenate dust or poisoned molasses destroys many of these. The weevils tend to go to the earliest cotton and if this is poisoned thoroughly, control measures are aided. Later, infestation counts are made weekly and the weevils watched closely. If the infestation runs as high as 5 per cent, weekly poisonings are made, using 6 to 10 pounds of calcium arsenate per acre. Heavier applications are made as the plants grow larger. When the infestation counts show many adult weevils, numerous young weevils hatching out, or many in the pupa stage, extra effort is put forth to keep poison on the plants. If rains occur, extra poisonings are made. On account of the difficulty of weevil control in this area, earlier, more frequent, and heavier applications of poison are used than are recommended by the Bureau of Entomology for weevil control. The methods outlined have been very satisfactory in holding the weevils in check and good crops have been made. Yields have averaged approximately a bale per acre for a 10-year period, while neighboring farmers who did not use poison made less than half a bale. However, some other factors also had a bearing in the matter.

Oil Content of Louisiana Cotton Seed. During two different years, samples of cotton seed have been taken from variety tests conducted in different parts of the State and have been analyzed for oil content by A. P. Kerr of the Fertilizer and Feedstuffs Laboratory. Table V gives the percentage of oil of different varieties at different places.

Table V. Oil Content of Cotton Seed in 1931 and 1935 Tests in Louisiana

Variety	Baton Rouge, Bench Land	Baton Rouge, Alluvial Land	St. Joseph. Alluvial Land	Calhoun, Hill Land	Varietal Average 1931	Baton Rouge, Bench Land	Baton Rouge, Alluvial Land	Crowley, Prairie Land	St. Joseph Alluvial Land	Calhoun, Hill Land	Varietal Average 1935
	%	%	%	%	%	%	%	%	%	%	%
Missdel 1	16.65	17.60	18.10	16.54	17.22	......	......	......	......	......	......
Delfos—1341	17.48	17.03	16.87	15.29	16.66	......	......	......	......	......	......
Half & Half	16.95	18.72	19.10	17.02	17.94	......	......	......	......	......	......
Rowden—40	17.00	17.41	17.39	16.11	16.97	......	......	......	......	......	......
Wilds	17.42	16.43	20.72	16.11	17.67	......	......	......	......	......	......
Delfos-531	16.23	16.81	17.68	15.24	16.49	18.90	21.50	18.80	21.75	17.70	19.7
Cleveland—5	15.64	16.55	18.42	17.58	17.04	......	......	......	......	......	......
Stoneville—2	15.54	17.62	18.97	15.65	16.94	......	......	......	......	......	......
Stoneville—3	17.80	18.07	17.97	16.92	17.69	18.50	20.20	19.70	21.75	17.85	19.05
Dixie Triumph	19.35	17.16	......	17.00	......	20.05	21.60	......	21.25	17.25	......
Acala—37	16.44	18.14	18.64	16.88	17.52	......	......	......	......	......	......
D&PL—4	18.93	17.03	18.87	16.39	17.80	......	......	......	......	......	......
D&PL 4-8	17.34	18.52	19.65	16.63	18.03	......	......	......	......	......	......
D&PL—10	19.92	17.18	17.64	15.65	17.59	17.95	19.55	18.10	20.10	17.50	18.6
Express—317	18.16	18.44	19.46	16.57	18.15	......	......	......	......	......	......
Mebane	16.71	16.65	16.00	14.83	16.04	17.25	19.30	16.50	19.25	16.40	17.7
Wannamaker Cleveland	17.42	17.91	17.41	15.17	16.97	......	......	......	......	......	......
Wilson Cleveland	17.09	17.00	17.99	14.60	16.67	......	......	......	......	......	......
Location Average	17.33	17.45	18.28	16.11	......	18.5	20.4	18.2	20.8	17.3	......

It is generally conceded that the varietal factor is of greater importance than any other in determining the oil content of seed. The above table shows that the soil on which the seed are grown does have some effect. The plantings on the richer alluvial lands consistently had seed with higher oil content.

COTTON CULTURE

During the past several years the Experiment Station has carried on a limited amount of cotton culture work at Baton Rouge. This has comprised tests of date of planting on bench land, spacing on bench and alluvial lands, ridged versus level or nearly level culture, effect of root pruning, and effect of subsoiling.

Date of Planting on Bench Land. The cotton in this test was planted on medium fertile land and given the normal culture for the region, the only exception being the variable planting date. The planting dates were April 1, 11, 21, and May 1 and 11. Blooming, boll opening, and yields for the different planting dates in 1933 are given in Table VI.

This experiment was run for a five-year period. The dates used covered the range of dates of practical importance in planting. There was some variation in results for different years, depending upon seasonal conditions. If the weather was cold and wet early in April, the first plantings gave poor stands and yields were lower in consequence. The later plantings usually gave good stands but their yields depended largely upon the prevalence and control of boll weevils. May 11 invariably gave lowest yields. In some years the May 1 plantings gave the highest yields, but April 21 ranked highest on the average.

Table VI. Date of Planting Cotton

Planting Date	Blooming Date	Days from Planting to Blooms	Bolls Open	Days from Blooms to Open Bolls	Pounds Seed Cotton per Acre, 1933	Pounds Seed Cotton per Acre, 5-Year Average
April 1	June 5	65	July 26	51	1819	1646
April 11	June 11	61	July 31	50	1780	1715
April 21	June 17	57	August 2	46	2191	1792
May 1	June 23	53	August 11	49	1086	1628
May 11	July 3	53	August 24	52	834	1446

Cotton Spacing. Many experiments have been conducted throughout the Cotton Belt to determine the proper width of spacing for cotton. In regions of rather low fertility and moderate rainfall, best results were obtained from close spacing of plants—8 to 15 inches apart. Where soil is rather fertile and rainfall heavier, wider spacings were found to give better results.

Spacing experiments were conducted for five years at Baton Rouge for the purpose of determining the best spacing for southern Louisiana conditions. These experiments were run on both alluvial and bench lands and included five spacings as follows: Unthinned; two stalks spaced 10 inches; two stalks spaced 20 inches; two stalks spaced 30 inches; and one stalk spaced 30 inches.

Studies were made on a number of factors which influence production and quality of lint, some of which were size of plant, rate of blooming, rate of shedding, length of staple, per cent of boll rot, lint percentage, size of bolls, and pounds of seed cotton per acre.

Table VII shows an average of the results from the five years' data.

Table VII. Results of Various Spacings on Growth and Yield of Cotton

Spacing	Height of Plant in Inches	Average Daily Blooming	Average Daily Shedding	Bolls Per Pound	Per cent Boll Rot	Seed Cotton per Acre
Bench Land Test						
Unthinned	34.8	47.1	43.8	78.0	13.5	999
2 Stalks 10 inches	37.8	48.2	39.8	73.7	11.5	1180
2 Stalks 20 inches	43.0	47.6	30.9	69.7	8.2	1269
2 Stalks 30 inches	42.2	44.0	26.2	68.0	10.2	1233
1 stalk 30 inches	43.3	41.9	15.3	64.3	8.2	1115
Alluvial Land Test						
Unthinned	42.7	74.7	157.0	91.0	14.5	1362
2 Stalks 10 inches	48.9	78.8	186.0	80.0	10.8	1823
2 Stalks 20 inches	50.3	69.6	156.0	77.7	9.9	1835
2 Stalks 30 inches	49.6	57.5	130.0	75.7	10.1	1786
1 Stalk 30 inches	47.7	49.8	77.0	72.0	7.6	1816

A study of the data shows that width of spacing has little effect on lint percentage, that the rate of blooming is somewhat higher in the narrow spacings, and that boll rot is appreciably higher in the closely spaced cotton. Plants were taller in the intermediate spacings, but more tonnage of plants was produced in the unthinned plots.

Rather marked effect on the size of bolls was found, the narrower spacings producing the smallest bolls, and the size of bolls increased as the spacings widened.

It appears that length of staple is affected to some degree by the width of spacing. An average of three years' data showed more than 1/16-inch difference in staple length between the widest and the narrowest spacings used.

Shedding was much heavier in the close spacings in the early part of the fruiting season and appreciably heavier for the average of the season.

The acre yields indicate that two stalks per hill spaced 20 inches apart in the drill is best on both the bench lands and the alluvial lands.

High and Low Bed Culture. Experiments have been conducted for six years to determine the effect of growing cotton on high beds or ridges as compared with low beds. Although eight experiments have been conducted, results are not conclusive. A number of factors, such as soil conditions, rainfall, cultivation, prevalence of boll weevil, etc., have a bearing on results and may vary different years. Consequently, considerable study is necessary to determine the principles involved. Table VIII gives a summary of the results obtained, although, as was stated above, they are not conclusive.

TABLE VIII. HIGH AND LOW BED COTTON CULTURE

Location	*Year*	*Height of Plants Inches*		*Yields Seed Cotton Pounds*	
		High Beds	*Low Beds*	*High Beds*	*Low Beds*
Bench land	1931	38.4	34.9	1536	1623
" "	1932	46.3	49.3	1016	1104
" "	1935	....	....	1804	1629
" "	1936	33.2	32.7	1172	1436
Alluvial land	1933	47.4	46.3	2677	2548
" "	1934	54.9	57.1	1250	1137
" "	1935	56.1	58.4	1777	1515
" "	1936	32.1	33.5	2020	1920

In three tests out of four, on the Bench land, the low bed plats gave the greater yields, while on the alluvial land, the high beds invariably gave better yields.

Effect of Root Pruning by Deep Plowing on the Growth and Production of Cotton Plants. On the richer lands of South Louisiana, there is a tendency for cotton plants to make such rank growth that they do not fruit well and there is much boll rot. This experiment was started to determine whether or not it was possible and practical to hold down the excess vegetative growth by root pruning in deep plowing. Three methods of plowing were tried—deep plowing near the plants with small shovel plows; medium deep plowing with large shovels on a double shovel; and shallow cultivation with buzzard wing sweeps.

Weather conditions affected results in a number of cases and made it more difficult to draw conclusions. Table IX gives the average plant height and plat yield of seed cotton for the different treatments for a six-year period.

TABLE IX. ROOT PRUNING EXPERIMENT

Treatment	1929		1931		1932		1933	
	Plant Height	*Cotton Yield*	*Plant Height*	*Cotton Yield*	*Plant Height*	*Cotton Yield*	*Plant Height*	*Cotton Yield*
	Inches	*Pounds*	*Inches*	*Pounds*	*Inches*	*Pounds*	*Inches*	*Pounds*
Deep plowing	53.1	84.5	29.5	166.4	41.6	133.0	43.3	49.6
Medium plowing	55.8	80.2	30.5	184.6	42.8	136.8	46.7	49.9
Shallow plowing	53.8	82.8	32.2	178.2	44.7	136.5	47.9	51.0

Continued

Treatment	1934		1935		Six-year Average	
	Plant Height	*Cotton Yield*	*Plant Height*	*Cotton Yield*	*Plant Height*	*Cotton Yield*
	Inches	*Pounds*	*Inches*	*Pounds*	*Inches*	*Pounds*
Deep plowing	54.2	51.5	52.4	185.0	45.8	111.7
Medium plowing	57.6	52.0	50.7	193.2	47.3	116.1
Shallow plowing	57.7	48.1	51.3	185.3	47.6	113.6

The deep plowing reduced the growth in height rather consistently but the decrease was not great. This decrease in height did not improve yields but seemed to reduce them. The decrease in yields was probably due to increased shedding that followed deep plowing. The margins of difference are slight and are probably not significant. The use of root pruning as a means of preventing excessive vegetative growth is of doubtful value as a practical measure, however.

Subsoiling Bench Land for Cotton. Over much of the Bench Land on the Experiment Station farm, the top surface of the subsoil is rather hard. If the season tends to be dry, few cotton roots penetrate it. Even the tap root turns, in most cases, when it strikes this layer and runs off laterally. In 1932 an experiment was run to see if breaking this hardpan by subsoiling would benefit cotton plants grown on the land. Four five-row plats were subsoiled by making furrows with a middle burster where the rows were to be, and running a subsoil plow in the bottom of the furrow. Then a bed was made on this subsoiled furrow. Four other five-row plats alternating with these were treated the usual way and used as checks. Good stands were obtained on all the plats and the cotton grew well and was very uniform. During the growing season no difference could be seen between the two sets of plats and when harvested there was practically no difference in yields, the total difference being but three pounds. Apparently subsoiling is of no value to cotton on Bench Land soil at Baton Rouge.

Cotton Root Studies. Rather extensive studies have been made of the root development of the plants of a number of field crops, but only a limited amount of work has been done on cotton plants. The Louisiana Experiment Station made certain studies for a period of three years on Lintonia silt loam bench land soil and on Sharkey clay alluvial land. Insofar as could be determined from the study made, there was no consistent difference in the root systems of 20 varieties grown in 1931. There was considerable difference in the spread of the roots in the two types of soil used. On the bench land soil, the roots were confined mainly to the upper 6 or 8 inches of soil but where the soil was exposed to the sun, there were few roots in the upper 2 or 3 inches. A few roots penetrated the subsoil to a considerable depth. One was traced to a depth of 7 feet, 2 inches. On the alluvial land the roots were well distributed through the upper 18 inches of soil and a few roots penetrated the soil below this for a considerable depth. One was traced to a depth of 5 feet, 2 inches.

It was observed that during dry seasons when the plants made less growth, there was less root development in lower layers of soil. This was probably due, in part, to the fact that the dryer subsoil was more dense and harder to penetrate.

As there were but few roots in the upper two or three inches of soil, ordinary cultivation is not apt to injure the plants seriously by breaking their roots.

(Additional data on cotton root development may be found in Louisiana Bulletin No. 232.)

Cotton Fiber Studies. Some preliminary studies have been made of the uniformity and length of staple of the leading commercial cotton varieties grown in Louisiana. Table X gives in brief, data obtained from a study of cotton grown on alluvial land at Baton Rouge in 1933.

OTHER FIBER PLANTS

During the past few years, the Crops and Soils Department has done a limited amount of work on ramie, hemp, and flax—other fiber crops of some interest but of slight value in the South in comparison with cotton.

Ramie. Ramie (*Boehmeria nivea*) is a plant belonging to the nettle family. Its bark contains a very strong fiber which is valuable for weaving cloth, making cordage, and for other purposes. Ramie has not come into extensive use because it is necessary to strip the bark from the plants by hand and then scrape it to remove the corky surface layer. Most of the ramie in commerce comes from China where there is an abundance of cheap labor.

The Experiment Station has grown ramie to supply material to people experimenting with decorticating machines, and to determine the productivity of the plant when grown under Louisiana conditions.

From the rather limited experiments carried on for five years, it seems that there is no question that ramie can be grown easily and that it will produce well in South Louisiana. In 1929 a planting was made on Lintonia silt loam soil of medium fertility. Four-foot rows were used, and pieces of root-stocks planted at one-foot intervals in the row. The first year, the plants were hoed twice and cultivated about the same as cotton. Since the plants were perennials, no planting was needed after the first year. Also, no hoeing, and not much plowing was done after the first year.

The first year the plants grew and spread but none were ready to cut for fiber. The second year, three cuttings were made, yielding a total of 42,000 pounds of

Table X. Cotton Fiber Studies

	Staple Length Ordinarily Given by Commercial Classers. Inches.	*Extreme Staple Length Given by Sorter. Inches*	*Mode in Sorter Array. Inches.*	*Per cent of Fibers 7/8-Inch and Longer*	*Commercial Classing of Machine-Ginned Sample. Inches.*	*Extreme Length in Array of Machine-Ginned Sample. Inches.*	*Per cent of Fibers 7/8-Inch and Longer in Machine-Ginned Sample.*
Wilson Cleveland	15/16 to 1	1	7/8	30.0	15/16	1 1/16	21.8
Half and Half	13/16 to 7/8	7/8	11/16	8.5	7/8	15/16	8.7
Dixie Triumph	15/16 to 31/32	1 1/16	13/16	41.9	31/32	1 1/16	36.9
Lankhart	1 to 1 1/16	1 3/16	1	65.7	31/32	1 1/4	41.5
Station Miller	31/32 to 1 1/32	1 3/16	15/16	57.0	1 1/32	1 1/8	48.3
Rowden—40	31/32 to 1 1/32	1 1/16	15/16	47.7	1	1 3/16	48.1
Acala—37-6	1 to 1 1/16	1 3/16	1 1/16	69.0	1	1 3/16	42.6
Cleveland—5	1 to 1 1/16	1 1/4	1 1/16	56.1	1 1/32	1 1/8	44.4
D&PL—11	1 to 1 1/16	1 3/16	15/16	42.2	1 1/32	1 3/16	45.1
D&PL—10	1 to 1 1/16	1 1/4	15/16	64.0	1 1/32	1 1/8	46.1
D&PL—4-8	31/32 to 1 1/32	1 3/16	15/16	64.3	1 1/32	1 3/16	47.4
Stoneville—2	1 to 1 1/16	1 3/16	15/16	57.4	1 1/16	1 3/16	49.2
Stoneville—3	1 to 1 1/16	1 3/16	1	72.8	1 1/16	1 3/16	43.7
Delfos—531	1 1/8 to 1 5/32	1 3/8	1 1/8	77.6	1 5/32	1 5/16	54.6
Delfos—965	1 1/8 to 1 5/32	1 5/16	1 1/16	77.4	1 3/32	1 5/16	51.2
Delfos—2323	1 1/8 to 1 5/32	1 5/16	1 1/8	74.0	1 5/32	1 3/8	64.9
Missdel—1	1 1/8 to 1 5/32	1 3/8	1 1/8	78.5	1 1/16	1 5/16	59.9
Missdel—2	1 3/32 to 1 1/8	1 5/16	1 1/16	73.8	1 1/16	1 3/16	42.1
Express—317	1 1/8 to 1 5/32	1 3/8	1 3/16	82.2	1 1/8	1 5/16	50.9
Wilds—5	1 3/16 to 1 1/4	1 1/2	1 5/16	84.0	1 7/32	1 7/16	67.8
Average				61.20%			45.76%

(Additional data on cotton fiber studies may be found in Louisiana Bulletin No. 259.)

green, unstripped stalks per acre. The third year, the plants had spread over the ground well and produced 91,810 pounds of green weight per acre, which was an excellent yield. About half of this weight was leaves, and only about one-fifth of the green stem weight was dry matter. Only 20 per cent of this dry matter was fiber. But that, however, gave a fiber yield of more than 1500 pounds per acre. This weight is greater than could ordinarily be expected of plants grown under field conditions. These plants were grown on small plats and were given good care and fertilization.

Hemp. In response to inquiries in regard to growing hemp in Louisiana, a small planting was made on Bench Land soil in 1931. All of the hemp was planted in rows and cultivated, a part of it being drilled thick in the row to grow plants for fiber, while the rest was planted in hills and grown for seed. The seed rows were thinned to one plant in a hill. The fiber rows were planted May 1, and the seed rows on April 6. Both sets of plants made good growth but they were more or less diseased, a number of them dying with a sclerotial fungus disease. It is probable that if plants were grown on the same land two years in succession, this disease would kill a large part of the plants as it does sugar beets. The fiber plats were cut and weighed on August 21, and yielded 19,600 pounds of green weight per acre. According to Dewey, of the U. S. Department of Agriculture, an average crop gives a green weight of 15,000 pounds per acre. No seed weights were taken from the seed plats. It appeared that a fair crop of seed was produced. Some of these fell to the ground and produced a volunteer crop in 1932.

Flax. On May 14, 1932, some small plats of flax were planted on Bench Land soil at Baton Rouge. The land was well prepared and the flax planted in narrow rows and cultivated. The seed germinated at once and plants made rapid growth but did not become large. They were 12 to 20 inches in height when harvested on July 22. It appeared that the weather was too warm for them. An earlier planting would probably have been better. When the harvesting was done, there were still some blooms but most of the leaves had been shed and nearly all of the pods were about ripe. There seemed to be few good seed in the pods and some of the pods were decaying. The frequent summer rains probably fostered this rotting. Many plants died from wilt or other fungus disease.

The green weight of plants at harvest on July 22, was 1750 pounds per acre. This was a low yield. Probably the yields would have been much better if earlier planting had been made but it is doubtful whether flax is a good crop for South Louisiana.

SUGAR BEET INVESTIGATIONS

The Louisiana Experiment Station has conducted sugar beet experiments intermittently for the past 30 years. About 1926, when sugar cane production declined due to cane diseases, there was an increased interest in beet growing. The Experiment Station employed D. N. Barrow to do experimental work with the crop and outlined rather extensive experiments with varieties, culture, fertilizers, etc. In some years, under favorable conditions, good yields were obtained and the sucrose content of the beets was good, running as high as 14 per cent. It soon developed that the sclerotial root rot, which attacks the beet roots in the field as they approaach maturity, was the limiting factor. It frequently happened that after they had been shipped to the factory for slicing, whole carloads of the roots would have to be thrown away because of the action of this fungus, and half or more of the beets might rot in the field if the harvest was delayed after warm weather started.

After Mr. Barrow's death in 1929, the work was turned over to H. B. Brown and some breeding work was begun, looking toward the development of a rot resistant strain. Individual plant selections of apparently resistant plants were made in fields where most of the beets were rotting. These selected roots were placed in cold storage and handled in various other ways to carry them through a dormant period. They were later disinfected and set out, but in most cases rotted. In a limited number of cases, the plants went through the winter and sent up flowering stalks in the spring. Seed was obtained from four of these plants and four progeny rows grown. It could not be observed that the plants in these rows were any more resistant than those from unselected seed. However, the roots from these rows were saved and an effort was made to get them to produce seed. Not one of them did produce seed, so the strains were lost. The breeder is badly handicapped by the difficulty of getting the plants to produce seed regularly.

It seems doubtful whether sugar beet growing in Louisiana will be very successful. It is too hot to grow them during the summer. If planted in the fall all of them may be killed by a winter freeze. This happened two years out of the six during which the writer made observations. One other year the winter was so warm and humid that leaf-spot diseases were very prevalent, and the roots made poor growth. If planting is done during the winter, the plants may live but the roots do not reach merchantable size before warm weather comes on. If the weather is warm when the plants approach maturity, nearly 100 per cent of the mature beets may be infected with the root rot organism. These infected beets rot quickly during warm weather if piled together in bulk preparatory to slicing. Considering all of these hazards, it seems doubtful whether sugar beet growing can be made a profitable industry in Louisiana.

PART II

H. B. Brown and Hugo Stoneberg*

CORN WORK

Adapted Varieties. It has been demonstrated many times that seed from our southern varieties of corn will produce better locally than seed from the early northern varieties such as are grown in the Corn Belt states. Unfortunately for southern farmers, seed dealers in the South sell much of this northern-grown seed. It looks good, is cheap, and is easily obtained.

Under some conditions the one-ear varieties grown in the South are better liked than the small-eared prolific varieties, but, in general, the prolific varieties give better yields. The most productive one-ear varieties in Louisiana are Tuxpan, Imperial White, and Sentell. Sentell is better adapted to North Louisiana, and Imperial White to South Louisiana. There are several good prolific varieties. Cocke's Prolific, Hasting's, and Whatley have all ranked high in yield of grain per acre, with little difference in their yields. Cocke's Prolific has a slightly larger ear than the other varieties mentioned. A good many growers object to the prolific varieties on account of the small ear. However, the increased yield from the small-ear varieties repays the grower well for the extra work in harvesting. Hill's Yellow Dent is intermediate between the prolific and one-ear varieties in regard to the number of ears produced. It is a good yielder and probably the best yellow corn in the State. Jarvis Prolific,

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Good's Golden Prolific, and Yellow Creole are other yellow varieties that have been grown in tests, but they have ranked rather low.

Imperial White, Tuxpan, and Mexican June have given better yields than other varieties when planted after June 1.

TABLE XI. CORN YIELDS IN ALLUVIAL LAND VARIETY TESTS AT BATON ROUGE, 1933-1936 (Bushels per Acre)

Variety	*1933*	*1934**	*1935*	*1936*	*Four Year Average*
Silvermine	27.2	10.9	62.5	51.8	38.1
Surcropper	36.4	16.3	64.8	58.9	44.1
Calhoun Red Cob	38.6	11.9	75.0	46.2	42.9
Hill's Yellow Dent	46.7	16.4	78.2	63.5	51.2
Sentell's White Dent	41.5	14.4	71.8	50.2	44.5
Yellow Creole	44.8	15.0	71.7	49.5	45.2
Cocke x Creole F_1	51.9	18.4	81.2	63.9	53.8
Cocke's Prolific	44.9	11.6	80.6	57.4	48.6
Hastings'	47.4	15.7	83.1	53.3	49.9
Tuxpan	51.6	12.3	81.2	57.4	50.6
Imperial White	49.9	13.1	71.7	49.1	45.9

*In 1934 the crop was badly damaged by a storm on June 16.

Effect of Mass Selection on Cocke's Prolific. Recent studies have shown that mass selection of corn, that is, picking out best plants and harvesting them together, is the most simple and most effective method of corn breeding for the practical corn grower in the South. Selection in inbred lines followed by crossing may give hybrids that will yield somewhat higher than can be obtained by mass selection, but this method of breeding is too much for the ordinary grower.

In 1915 the writer began mass selecting a strain of Cocke's Prolific corn then being grown on the Experiment Station Farm at State College, Mississippi. The plants chosen were vigorous and had two fair-sized ears with good husk protection and medium smooth, semi-dent kernels. This semi-dent kernel seemed to be a hybrid form intermediate between rough dent and smooth flint corn. Being of hybrid constitution, selection over a period of 20 years failed to fix the type. The smooth-ear and rough-ear forms still arise, but the strain, having hybrid vigor, has given high yields very consistently. In Mississippi it ranked high in tests for 10 years. It was brought to Louisiana in 1927 and has the highest average yield of any variety grown in tests in Louisiana since that time.

The Use of Crossed Varieties. In 1928 a cross was made between Cocke's Prolific and Yellow Creole corn, the latter being a deep yellow, smooth kernel, prolific variety. The idea was to get a yellow corn that would have the high yielding qualities of Cocke's Prolific and the weevil resistance of the Yellow Creole. The first generation plants grown following the cross proved to be high yielders but the kernels were only a light yellow. The cross has been repeated some five times since 1928 and in every case the F_1, or first generation, plants have ranked high in yields, being in first place or near it in most instances.

Plant selections were made in the first generation plots in 1929 and only yellow kernels planted from the plants selected. Similar plans were followed in 1930 and each subsequent year. In 1936, the strain was nearly pure yellow. Every kernel contained some yellow pigment but there was a considerable variation in the depth of coloring. Further selection will probably deepen the coloring and make it less variable. This strain has ranked better in yields than the average of varieties in the tests, but has not done as well as the first generation crosses.

Several other crosses between varieties have been made, looking toward high yielding first generation strains possessing other desirable qualities, but up to the present none has proven as productive as the Cocke's Prolific×Yellow Creole cross mentioned above.

In 1932, Hugo Stoneberg, local corn breeder for the Bureau of Plant Industry, U. S. Department of Agriculture, began experiments in the production of a yellow strain of Cocke Prolific, utilizing the yellow color from Yellow Creole corn. Cocke Prolific and Yellow Creole were crossed and then in order to concentrate the Cocke Prolific "blood" the hybrid was backcrossed to the Cocke Prolific parent two or three times, each year planting only the yellow kernels from the hybrid strains. After the series of back-crosses is completed, selfing is required to fix the yellow color. Up to the present, the various back-crossed generations have yielded about as well as the Cocke Prolific parent.

Corn Breeding by Inbreeding Methods. Corn breeding by selecting in inbred lines and crossing certain of the inbred strains has consistently given increased yields over other methods of corn breeding used in the Corn Belt States. In 1923, the Division of Cereal Investigations, U. S. Department of Agriculture, Hugo Stoneberg in charge, started inbreeding corn at Baton Rouge in co-operation with the Louisiana Experiment Station. Most of the strains with which the work was started proved to be unsuited to Louisiana and no outstanding crosses were secured during the earlier years.

In 1926, work was started with Cocke's Prolific, Whatley, Hasting's, Mosby, Delta Prolific, and Creole. These were among the best local varieties and since 1926, much better progress has been made. Each year many plants have been inbred by self-pollination and several hundred inbred strains produced. These are tested and many of the weaker and undesirable strains discarded. Only the strong sturdy strains having a good stalk, good root systems, a prolific tendency, and ample husk protection for the ear are saved. The strains that are saved are crossed in various combinations and first generation strains grown. All of these crossed strains are much more vigorous and better yielders than their inbred parents and some have given indications of being better yielders than the original varieties with which the work was started.

The various crosses made in this corn breeding work have been called "single crosses," "double crosses," "top crosses," and "synthetic varieties." The "single cross" is simply the first generation, or F_1, hybrid between two inbred lines. Single crosses yield well but they are not of much immediate practical value because present inbred strains are low yielding and as the crossed seed must be produced on one of the lines, the yield of seed usually is small and therefore too expensive to be used in practical corn growing. This difficulty is avoided by making what is known as a "double cross." This is produced by crossing two productive single crosses. The double cross strains are no more vigorous and they yield little, if any, better than the single crosses. Their main advantage lies in the fact that the crossed seed may be produced more economically and sold more cheaply. "Top crosses" are crosses between an inbred strain and an ordinary open-pollinated variety. The crossing usually is accomplished by planting the two in alternate rows and detasseling the inbred strain. All of its plants are thus cross pollinated. The crossed seed thus produced is tested in yield tests the following year. By this means it is possible to get some measure of the comparative merits of a large number of inbred lines because a number can be crossed in one field without the labor of hand pollination. On the basis of yield tests over a period of years, the better lines can be determined and used in single and double crosses. The main value of top crosses is in determining merits of different inbred lines, but since they have yielded well in tests when compared with commercial varieties, it is possible that they may have some value as commercial hybrids. "Synthetic varieties" are produced by mixing the seed of the better inbred lines and allowing them to inter-pollinate.

During the years 1935 and 1936, some of the hybrid strains produced in the breeding plots yielded 25 per cent more than Cocke's Prolific. These results look promising. However, more tests at various localities in the State are necessary to determine the practicality of this method of corn breeding in Louisiana. (The Experiment Station has no hybrid seed corn for distribution.)

Plant Characteristics Which Should Guide in Selection Work. Some years ago it was thought that an ideal corn stalk should have low ears, medium long husks, rough kernels, deep kernels, and a medium short shank. Subsequent research showed that selecting for some of these characters tended to reduce yields. It was found, for instance, that strains with smooth ears would produce more corn than rough-ear strains, and that shallow-kernel strains would produce more than deep-kernel ones. Since most of this testing was done in the North, it was thought that it might be worthwhile to see if the same held true for southern varieties, and whether we are making a mistake in selecting for low ears, long husks, short ear shanks, and two-ear stalks. To determine this, high and low ear, long and short husk, rough and smooth kernel, deep and shallow kernels, long and short shank, and one and two ear selections were made and the selections having the contrasted pairs of characters planted in replicated alternate plats for testing yields and certain other features. Table XII gives the plot yields in pounds of ear corn for a three-year period. Some of the results do not appear to be very consistent, but some indications are shown. It will be necessary to run the experiment for a longer time to get more definite results.

Table XII. Corn Selection for Plant Characteristics

	1933 Pounds	*1934 Pounds*	*1935*		*1936 Pounds*
			Pounds	*Bushels per Acre*	
High Ear	207.6	123.3	476.0	61.8	204.7
Low Ear	176.9	159.6	453.5	58.9	232.4
Long Husk	285.6	166.0	321.9	43.8	165.2
Short Husk	296.2	136.7	306.5	41.7	158.3
Long Shank	182.2	143.1	184.5	59.8	.....
Short Shank	181.7	140.4	176.2	57.1	.....
One-Ear Selection	396.7	65.8	313.5	42.6	.....
Two-Ear Selection	437.5	95.6	333.4	45.3	.....
Smooth-Ear Selection	224.5	127.3	331.4	57.3	.....
Rough-Ear Selection	179.9	78.7	324.6	56.2	.....
Deep-Grain Selection	.....	117.3	177.6	57.5	.....
Shallow-Grain Selection	.....	101.6	191.2	61.9	.....

Date of Planting at Baton Rouge. This experiment was run to get data on the comparative yields of and insect damage to corn planted at various periods of the planting season. Yellow Creole corn was planted on medium fertile alluvial land on the dates shown in the table below. Otootan soybeans were planted in the corn. The experiment was run for the fourth year in 1936. Comparative yields and insect damage for the different planting dates have been much the same other years as in 1936. There seems to be no significant difference in yield from plantings made prior to June 1. After that date there is a rapid decrease in yields. Bud worms are much worse on March and April plantings than on others.

TABLE XIII. CORN DATE OF PLANTING EXPERIMENT, 1936

Date Planted	*Yield, Bushels per Acre*	*% Plants Killed by Bud Worms*	*% Plants with Cane Borers*	*% Plants with Corn Ear Worms*	*% Plants with Grain Weevils*	*% Smutty Ears*	*% Plants with Brown Leaf Spots, (Physoderma)*	*% Ears with Rots Other Than Smut*
February 25	56.2	9.2	25.9	73.0	24.9	0.18	25.4	1.1
March 12	55.3	29.4	22.9	43.2	16.0	0	29.4	1.5
March 29	59.1	17.0	21.7	23.4	16.6	0.67	27.7	4.2
April 13	46.1	.7	29.3	61.1	16.9	1.28	33.5	6.2
April 29	56.2	.2	55.4	90.9	5.9	1.11	26.7	8.5
May 15	58.2	0	74.0	85.7	3.0	1.5	1.2	8.9
June 1	44.3	0	81.6	86.2	2.8	3.6	3.1	11.4
June 17	20.2	0	84.4	84.1	22.96	9.0	.3	8.4
July 3	7.3	.3	100.0	79.4	57.2	15.3	0	3.0

Corn Spacing with Soybeans Planted in the Row. In 1929, corn spacing work was started on medium fertile alluvial land at Baton Rouge. In 1930, similar work was also started on bench land. Biloxi or Otootan soybeans were planted in the corn row when the corn was planted. Yellow Creole corn was planted on the alluvial land and Cocke's Prolific on the bench. In all instances, except those noted, 4-foot rows were used and spacings within the row were one stalk per hill at the distances specified in the tables. About 400 pounds per acre of a complete fertilizer was used on the bench land. In some years the stands were not satisfactory, making results unreliable. No report is made for such years.

The width of spacing for best results varies considerably, depending upon the fertility of the soil and the amount of moisture available. As the soil used in the tests reported was medium fertile and rainfall was moderate, close spacing gave best results, as a rule. A much wider spacing is needed on poorer land.

Tables XIV and XV give in some detail the results obtained.

Effect of Furrow, Level, and Ridge Planting on Corn Production at Baton Rouge. In 1929 an experiment was started to show that level culture would produce better corn yields than ridge culture. To the surprise of the experimentor, the ridge plats gave about 10 per cent better yields at harvest. Thinking that this might have been just accidental, the experiment was run again in 1930. This year the difference in the

Table XIV. Corn Spacing on Alluvial Land

Spacing	Yield in Bushels per Acre					Five Year Average
	1929	1930	1931	1932	1933	
12 Inches	53.5	39.0	38.2	43.2	57.2	46.2
18 Inches	....	....	....	....	43.8	....
24 Inches	48.8	37.5	31.0	44.2	41.8	40.6
36 Inches	44.9	35.7	28.6	37.3	34.7	36.2
48 Inches	39.2	34.8	26.4	33.6	21.9	33.2

Table XV. Corn Spacing on Bench Land

Spacing	Yield in Bushels per Acre						Six Year Average
	1931	1932	1933*	1934†	1935†	1936*	
12 Inches	22.8	49.5	33.9	12.5	17.4	26.1	27.0
18 Inches	....	....	36.8	15.9	19.2	28.3	25.1‡
24 Inches	19.6	45.7	38.7	14.9	22.7	28.6	28.4
36 Inches	16.3	36.7	35.8	12.4	19.7	24.4	24.2
48 Inches	14.8	29.2	....	....	....	....	....

*A 3½-foot row was used on the bench land in 1933 and 1936.
†Planting was made on poor land and weather was dry.
‡Four-year average.

appearance of the plants in the two sets of plots was striking, the plants on the ridge plots being a darker green color and more vigorous. At harvest the ears on the ridge plots looked larger and weighed 22 per cent more. It began to appear that we were showing ourselves something and plans were made for running the experiment for a longer time. Beginning in 1933, a duplicate experiment was run on alluvial land and furrow plantings were made in addition to the other two.

The rows used were four feet apart. The ridges were about 1 foot high when planting was done and were cultivated to maintain the ridge. The furrows used were about six inches below the level and were filled by throwing dirt to the corn in cultivation. Soybeans were planted in the rows on alluvial land but were not used on the bench land.

For a period of seven years, the ridge culture invariably gave better yields than the level, as may be seen in Tables XVI and XVII. In some years the margin of difference was not great enough to be significant, but in other years it showed clearly in the appearance of plants, and there was a considerable difference in yields. Preliminary studies have shown that the soil in the ridges is more porous and better aerated than the soil on the level plots. This may account for some of the difference in the early growth of plants. In all cases except one, the furrow planting also gave better yields than the level planting.

While it appears that ridge and furrow culture are better than level culture at Baton Rouge, it is not at all certain that they would be best in other places.

Effect of Soybeans on Corn Yields when Planted in the Corn Rows at the Time the Corn Is Planted. As a rule, soybeans growing in a row of corn tend to interfere with

TABLE XVI. YIELDS OF GRAIN ON BENCH LAND (Bushels per Acre)

Plots	1929		1930		1931		1932		1933	
	Bu.	*% Increase Over Level*	*Bu.*	*% Increase Over Level*	*Bu.*	*% Increase Over Level*	*Bu.*	*% Increase Over Level*	*Bu.*	*% Increase Over Level*
Level culture	58.8	....	26.9	....	37.0	....	41.6	....	36.8	....
Ridge culture	61.9	10.9	32.6	22.1	42.7	13.4	43.6	4.8	38.1	3.5
Furrow culture	....	....	....	....	....	....	....	....	....	....

Continued.

Plots	1933*		1935		1936	
	Bu.	*% Increase Over Level*	*Bu.*	*% Increase Over Level*	*Bu.*	*% Increase Over Level*
Level culture	30.9	....	43.8	....	17.4	....
Ridge culture	33.7	9.1	48.9	19.5	20.2	16.1
Furrow culture	....	....	40.4	– 7.7	20.6	18.4

*A duplicate test on bench land was run in 1933.

TABLE XVII. YIELDS OF GRAIN ON ALLUVIAL LAND (Bushels per Acre)

Plots	1934		1935		1936	
	Bu.	*% Increase Over Level*	*Bu.*	*% Increase Over Level*	*Bu.*	*% Increase Over Level*
Level culture	30.7	....	36.9	....	29.7	....
Ridge culture	33.9	10.7	44.2	19.5	33.4	12.2
Furrow culture	35.0	14.1	37.8	2.4	33.3	12.0

its growth somewhat like weeds do when growing in the row. The heavier the growth of the bean vines, the poorer the soil, and the scarcer the supply of moisture in the soil, the more harm the beans do to the current crop. However, the harm that a heavy growth of beans does to a particular crop may be offset by the help they give a succeeding one.

Experiments to determine the effect of soybeans in corn were started on bench land soil in 1929 and conducted on the same plots for five years. Cocke's Prolific corn and Otootan soybeans were used and all the bean vines and corn stalks were turned back into the soil. Fifty pounds of nitrate of soda, 300 pounds of superphosphate, and 50 pounds of muriate of potash per acre were applied each year before planting.

In Table XVIII, comparison with the figures from plats growing corn alone will show that soybeans in the corn row reduced yields considerably the first two years. After that time, however, the soil-renovating effect of the beans began to show; the plats with beans made the better yields of corn grain, and the corn stover was also heavier. A part of the profit from growing the beans was had in the soil enrichment, or in the soybean hay or seed that could have been harvested.

TABLE XVIII. EFFECT OF SOYBEANS ON CORN PRODUCTION WHEN PLANTED IN ROW WITH THE CORN

Year	*Bushels Corn on "Corn Alone" Plots*	*Bushels Corn on "Corn and Bean" Plots*	*Bean Hay per Acre on "Corn and Bean" Plots*	*Corn Stover on "Corn Alone" Plots*	*Corn Stover on "Corn and Bean" Plots*	*% Gain or Loss from the Use of Soybeans*
1929	41.9	28.0	4020#	....	....	−19.1
1930	40.7	25.9	2736	....	....	−33.6
1931	19.6	22.1	....	....	....	+12.7
1932	26.7	40.5	3478	....	....	+51.7
1933	24.4	33.0	2200	8800#	11600#	+35.2

FIGURE 3. COTTON AFTER CORN AND SOYBEANS.

(Further data on the effect of soybeans on corn yields are given in Louisiana Bulletin No. 265.)

Effect of Soybeans on Corn Yields when Planted in the Same and in Alternate Rows. This experiment was conducted during the same years and on plots adjacent to those on which the experiment mentioned above was conducted. Soil, fertilizer, weather conditions, and varieties were about the same in the two experiments. In the alternate row experiment, two sets of four plats each were used. There were three rows of beans and three rows of corn in each plat of one set, and six rows of corn with beans

FIGURE 4. COTTON AFTER CORN IN WHICH THERE WERE NO SOYBEANS.

in all of the rows in each plat of the other set. The same amount of seed of corn or of soybeans that was planted in three rows in one case was planted in six rows in the other. When thinning the corn, an effort was made to preserve the same ratio. The beans were not thinned. The plats were rotated each year.

Table XIX gives data on the yields following the two methods of planting. It will be observed that in every instance except one, the every-row planting gave the best corn grain yields. The one year that the alternate row plats led, 1930, was a dry one in which growth conditions were not good. Although the evidence is not very conclusive, it appears that the alternate row planting may be more satisfactory under less favorable conditions. This accords with the views of farmers in poor land areas and in regions where droughts are common. There seemed to be no significant difference in yield of soybean hay following the two methods of planting.

Effect of Rate of Soybean Seeding in Corn on the Production of Corn Grain, Corn Stover, and Soybean Vines. It is the consensus of opinion that increasing the rate of seeding soybeans in corn will result in decreased corn yields. Experiments were

Table XIX. Data on the Effect of Planting Corn and Soybeans in the Same and in Alternate Rows

Year	*Bushels Corn, Alternate Row Plots*	*Bushels Corn, "Every Row" Plots*	*Bean Hay, Alternate Row Plots*	*Bean Hay, "Every Row" Plots*	*Corn Stover, Alternate Row Plots*	*Corn Stover, "Every Row" Plots*
1929	36.6	40.7	3777#	3982#	.....	......
1930	18.1	15.8	2971	3097	......	......
1931	19.1	21.1	....	....	......	......
1932	32.3	40.9	3025	2423	......	......
1933	22.6	26.3	1833	1956	8433#	10037#
Aver.	25.7	28.9	2803	2679	......	......

conducted for a five-year period to get data on this question. The experiments were conducted under conditions similar to the other local experiments discussed above, except that they were planted on rather fertile Mississippi River alluvial land, and Yellow Creole corn was used. A rate of seeding of 10, 15, and 20 pounds per acre of Otootan soybeans was used. The soybeans were planted in the corn rows when the corn was planted. They made good growth, covering the middles between rows completely.

From the data given in Table XX, it appears that the variation in rate of seeding used was not sufficient to make any significant difference in yield of corn grain or corn stover.

Table XX. Effect of Rate of Seeding Soybeans in Corn

Rate of Seeding	*Year*	*Bushels Corn per Acre*	*Pounds Corn Stover per Acre*	*Pounds Soybean Vines per Acre*
Ten pounds beans per acre	1929	63.0	......	15,400
	1930	48.4	......	17,000
	1931	63.9	23,656	7,000
	1932	....	20,460	12,899
	1933	72.3	23,980	7,752
	Average	61.9	22,699	12,010
Fifteen pounds beans per acre	1929	63.7	......	14,550
	1930	44.5	......	18,632
	1931	59.6	24,187	10,070
	1932	....	20,900	13,688
	1933	67.6	21,418	9,656
	Average	58.8	22,168	13,315
Twenty pounds beans per acre	1929	62.1	......	13,750
	1930	46.1	......	19,312
	1931	58.7	23,843	12,800
	1932	....	19,910	14,713
	1933	65.9	23,489	8,840
	Average	58.2	22,414	13,883

Effect of Soybeans on the Following Crop of Corn when the Beans Are Cut for Hay or when Plowed Under. Only a limited amount of work has been done to determine the effect of soybeans on the following crop when cut off for hay, or when plowed under. Most of the experiments that have been conducted showed that if the beans were cut for hay, about 50 per cent as much benefit would be obtained as when turned under. Local experiments to get data on this question were started on bench land soil at Baton Rouge in 1929. The general conditions of the experiment were similar to conditions for other corn and soybean experiments discussed above. Twenty one-row plots were used for each of three treatments—corn alone, soybeans turned under, and soybeans cut for hay. In 1929, 4263 pounds of hay per acre were grown on the bean plats. In 1930 all the plots were planted in corn, and in 1931 beans were again planted on a part of the plots, and so on, a two-year rotation being followed. After 1931, the corn-alone plots were allowed to lie fallow when the other plots were in beans. In 1934 all the plots were damaged by a tropical storm in June, and in 1936 the weather was too dry for good corn production. Table XXI gives the relative yields following the different treatments. It may be seen that the beans gave large and consistent increase in yields and that turning the beans under gave about twice the benefit that growing them for hay gave.

TABLE XXI. CORN YIELDS AFTER SOYBEANS WERE TURNED UNDER OR CUT FOR HAY

Year	*Plots with Beans Turned Under*		*Plots with Beans Cut Off for Hay*		*Plots that Grew no Beans*
	Bushels Corn per Acre	*% Gain from Beans*	*Bushels Corn per Acre*	*% Gain from Beans*	*Bushels Corn per Acre*
1930	30.5	55.6	24.1	22.9	19.6
1932	50.2	162.3	33.3	74.3	19.1
1934	21.0	98.1	19.5	83.9	10.6
1936	23.4	284.2	13.7	124.0	6.0

PART III

JOHN P. GRAY AND DAWSON M. JOHNS*

SOYBEANS

Soybean Varieties. Soybean variety tests have been conducted in Louisiana each year since 1929. During that time a large number of the leading commercial varieties have been tried on different soil types. Results from these tests show the relative yielding ability of the various varieties.

The soybeans grown in Louisiana are of two general types: the viney type, of which Otootan, Laredo, Barchet, and Louisiana Selection 108 are examples; and the upright or stiff-stem type, which includes Biloxi, Mammoth Yellow, Tokyo, Delsta, Mamloxi, and Looney-2. The varieties of the viney type have fine stems with numerous branches and rather small leaves. Having fine stems, they make a better quality of hay; and, since the vines cover the ground well, they are better to plant in corn to keep down grass and weeds after the corn is laid by. The beans of the upright type have coarser, more woody stems, and large leaves. They make a poorer

* J. P. Gray collected most of the data given. D. M. Johns prepared the discussion and collected data in 1936.

quality of hay, but are more easily harvested with machinery and, as a rule, produce more seed than the other type. The Otootan has led in hay yields in most tests that have been conducted in the State. Seed yields have usually been low due to the damage caused by insects. Of the older varieties, Tokyo, Looney-2, and Mamloxi made the best seed yields in 1935 and 1936.

The Avoyelles, U. S. Selection 71570, and Palmetto are three new varieties that give promise of value for Louisiana. They are of a semi-viney type, make nearly as much hay as the Otootan, and the quality of the hay is good. Their seed yields in 1935 and 1936 were excellent—better than those of any other varieties grown. The Avoyelles has black seeds. The other two new varieties have yellow seeds, which make them satisfactory for growing for oil production.

Table XXII gives the hay and seed yields on bench land at Baton Rouge and the average hay yields in State tests, expressed in percentage of Otootan hay yields in the same tests.

Table XXII. Soybean Variety Tests

Variety	*State Average Hay, % of Otootan*	*Bench Land—Baton Rouge*					
		Years in Test	*Cured Hay Pounds per Acre*		*Hay, % of Otootan*	*Seed per Acre, Bushels*	
			Av. 1929-36	*1936*		*1935*	*1936*
Otootan	100	8	6314	6572	100	8	0
Avoyelles	92	2	6183	6300	92	22	3
Biloxi	89	8	5123	5795	81	11	3
Mamloxi	77	4	4377	4006	68	14	6
Delsta	80	4	4847	5134	72	10	9
Delnoshat	75	2	4866	5172	70	..	3
Tokyo	88	7	4209	5639	68	16	6
U. S. 71570	89	2	6191	5912	92	23*	10
Chiquita	76	2	4832	5484	72	10*	8
Looney—2	76	3	4930	5911	75	20	8

*Newer Strains Test.

Edible Soybeans. All varieties of soybeans may be cooked and eaten as table food, but certain varieties such as Easycook, Rokusun, and Hahto are the most satisfactory. They are earlier and more productive than some other varieties and the beans are more palatable. They may be eaten as a green vegetable or the dried beans may be used. They are cooked and seasoned like ordinary garden beans. The green beans can be shelled more easily after the pods have been placed in boiling water for about three minutes.

Soybeans are richer in fats and proteins and lower in carbohydrates than other beans and peas.

SOYBEAN CULTURE

Width of Rows. Otootan soybeans were planted in plats with rows varying in width from 1 foot to 8 feet. Broadcast plots were also included for comparison. The yield of hay increased as the width of rows decreased from 8 feet to 2 feet. The difference in yield between the 2-foot, 1-foot, and broadcast plats was very small. A much better quality of hay was produced on the narrower rows. The diameter of stalk, height of plant, and number of branches per plant decreased as the width of row decreased, including the broadcast plot. In general, the 2-foot rows gave best results for hay production. Rows of this width permitted plowing to keep down the weeds. With the closer spacing, this could not be done economically.

Down to the 3-foot spacing, the yield of seed increased as the width of row decreased. The difference in yield between the 3-foot and 2-foot rows was not significant, however. The seed yields were considerably lower on the 1-foot rows and broadcast plot. For seed production, rows 3 feet apart seem most desirable. Fewer seeds are required for planting and less time is required for cultivation.

TABLE XXIII. YIELDS FROM VARIOUS ROW WIDTHS

Width of Rows	1931		1932		1933		1934		4-Year Average	
	Hay, lbs. per Acre	Seed, Bus. per Acre	Hay, lbs. per Acre	Seed, bus. per Acre	Hay, lbs. per Acre	Seed, bus. per Acre	Hay, lbs. per Acre	Seed, bus. per Acre	Hay, lbs. per Acre	Seed, bus. per Acre
8 feet	3363	5.4	4261	6.5	4104	1.9	4065	7.1	3948	5.2
6 feet	4280	6.5	5917	8.1	5030	3.7	5290	9.7	5129	7.0
4 feet	4982	8.1	6045	8.2	5950	2.8	6068	9.9	5761	7.3
3 feet	5537	10.8	6570	9.2	6483	3.2	6119	12.1	6177	8.8
2 feet	6643	10.4	7569	11.4	7079	1.7	7157	9.5	7112	8.3
1 foot	6863	9.3	7939	6.9	5524	.8	8282	7.8	7152	6.2
Broadcast	5745	9.4	7906	7.2	6114	3.3	8826	6.0	7148	6.5

Rate of Seeding. The quantity of seed required to plant an acre varies with the size of the seed. A much greater weight of large seed is required to plant a given area than is required to plant the same area with small seed. The Biloxi, one of the large-seeded varieties, and Otootan, one of the small-seeded ones, were tried in a Rate of Seeding experiment which began with 5 pounds per acre and increased by 10-pound increments to and including 60 pounds. The Biloxi produced the highest yield of hay with a seeding of 30 pounds per acre. The Otootan also produced the highest yield of hay at the 30-pound rate, but a good yield was produced with the 10-pound seeding. The difference in the hay yield of the Otootan was not sufficient to offset the cost of the additional seeding.

Seed yields of both varieties did not vary a great deal with rate of seeding. The 20-pound rate is sufficient for seed production.

Date of Planting. The soybean can be planted over a rather wide range of dates, due to its ability to withstand the cold weather in late spring and hot weather in the summer. Experimental plantings were made of the Biloxi and Louisiana Selection 60 at 15-day intervals from March 5 to August 10. The highest yield of hay was secured from the March 17 planting. Good yields were secured from all plantings made before July 1; however, there was some falling off in yields from plantings made after April 27. Differences in seed yields from plantings made after March 15 and before June 15 were not significant.

Soybeans may be planted any time after the danger of frost is past. However, when grown alone, especially for seed production, less cultivation is required if extremely early planting is not practiced.

TABLE XXIV. RATE OF SEEDING SOYBEANS

Rate per Acre	1931		1932		1933		1934		4-Year Average	
	Hay, lbs. per Acre	*Seed, Bus. per Acre*	*Hay, lbs. per Acre*	*Seed, bus. per Acre*	*Hay, lbs. per Acre*	*Seed, bus. per Acre*	*Hay, lbs. per Acre*	*Seed, bus. per Acre*	*Hay, lbs. per Acre*	*Seed, bus. per Acre*
Biloxi										
5 pounds	4057	5.1	3758	3.6	3462	.9	3345	1.9	3656	2.9
10 pounds	4738	9.1	3948	3.2	3929	.9	4512	4.5	4282	4.4
20 pounds	5065	10.9	3867	6.4	4201	.9	4474	6.9	4402	6.3
30 pounds	5746	10.9	5174	6.8	4357	.9	5446	8.9	5181	6.9
40 pounds	5174	10.2	4684	4.1	5096	.9	5329	6.5	5071	5.4
50 pounds	5201	10.5	5147	4.1	4824	.9	5252	7.3	5106	5.7
60 pounds	5174	12.9	4656	6.4	4746	.9	5563	8.4	5035	7.2
Otootan										
5 pounds	4684	4.9	4901	9.1	4590	1.1	5018	6.9	4798	5.5
10 pounds	4956	8.5	5364	8.2	4668	1.3	5679	6.3	5148	6.1
20 pounds	5010	8.5	5773	11.8	5135	.9	5496	9.9	5353	7.8
30 pounds	5058	8.1	5963	12.3	5213	1.1	5913	9.3	5425	7.7
40 pounds	4956	8.3	5501	9.5	4746	.9	5718	13.6	5230	8.1
50 pounds	4793	6.6	5746	10.0	4824	1.1	5252	10.8	5154	7.1
60 pounds	4956	6.8	5609	10.9	5057	.9	4979	9.3	5050	4.0

Grazing. Preliminary tests indicate that soybeans may give profitable returns when grown for grazing purposes. Otootan soybeans were cut at various heights to find the closest grazing that the plants would survive. A high percentage of the plants died when cut below the lowest leaf. Only a few of the plants failed to make new growth when the plants were cut at a height of 7 to 10 inches, and sufficient growth was produced within three to four weeks for another grazing. Plants with only the top leaves removed required still less time. After the second cutting, plants cut within 7 to 10 inches of the ground produced sufficient growth for a third grazing. Consecutive plantings made at different dates during the spring and summer will provide for continued grazing.

Inoculation. It is not necessary to inoculate soybean seed when they are planted on land which has grown soybeans in a crop rotation, according to soybean inoculation tests conducted in 1935 and 1936.

Table XXVI shows no significant difference between plats in the yield of hay or seed. The inoculation of soybean seed is necessary when they are to be planted on land which has not previously grown soybeans. Inoculation may be accomplished by the use of pure cultures sold by seed dealers, or by the use of soil from a field which has grown soybeans. Both methods give good results.

(Additional data on soybeans may be found in a soybean bulletin to be published in the near future.)

COWPEAS

Formerly, cowpeas were used extensively in Louisiana for hay and for soil improvement. They would make good growth in corn when planted when the corn was laid by, and they made a quick hay crop when planted alone. The seed could be

Table XXV. Date of Seeding Soybeans

Date of Planting	1931 Hay, lbs. per Acre	1931 Seed, Bus. per Acre	1932 Hay, lbs. per Acre	1932 Seed, bus. per Acre	1933 Hay, lbs. per Acre	1933 Seed, bus. per Acre	1934 Hay, lbs. per Acre	1934 Seed, bus. per Acre	4-Year Average Hay, lbs. per Acre	4-Year Average Seed, bus. per Acre
Biloxi										
March 5	5641	1.3	5855	5.4	....	....	....	....	5748*	3.4†
March 17	6454	4.7	5664	4.8	....	....	5349	2.8	5822*	4.1†
April 6	6353	4.7	5228	4.8	6127	.5	6360	5.9	6012	4.0
April 27	5997	5.5	6045	4.2	5213	.4	5602	10.2	5714	5.1
May 18	5692	6.4	5174	4.3	3482	.5	4532	6.8	4720	4.5
June 8	6149	9.3	3594	3.6	2256	.9	3948	10.4	3987	6.1
June 29	4752	8.9	1525	....	3287	1.1	2606	5.4	3043	5.1*
July 20	2694	7.0	1416	....	1945	....	1556	5.6	1904	6.3†
August 10	1779	2.9	....	....	....	....	1206	....	1493†	2.9‡
Louisiana Section 60										
March 5	6607	2.4	6508	6.7	....	....	....	....	6558†	4.5†
March 17	6759	4.3	7298	5.4	....	....	5738	23.8	6598*	11.2†
April 6	6607	5.4	5582	5.5	6730	.7	5660	26.8	6144	9.6
April 27	6759	6.9	5664	4.7	6730	.8	4376	20.0	5882	8.1
May 18	7242	6.8	4983	4.8	4318	1.6	3618	24.0	5040	9.3
June 8	8182	11.0	3676	4.2	2879	1.0	3696	26.6	4608	10.7
June 29	6124	8.7	1879	3.6	4143	2.7	3054	14.0	3800	7.3
July 20	3650	7.3	1607	3.0	2490	.9	1712	....	2365	3.7*
August 10	2287	3.0	....	....	....	....	1167	....	1727†	3.0*

*3-Year average.
†2-Year average.
‡1-Year average.

Table XXVI. Soybean Inoculation Test

Treatment	1935 Hay lbs. per Acre	1935 Seed bus. per Acre	1936 Hay lbs. per Acre	1936 Seed bus. per Acre	Average Hay lbs. per Acre	Average Seed bus. per Acre
Inoculation— Soybeans not grown year before*	4123	19.6	5134	12.6	4628	16.1
No Inoculation— Soybeans not grown year before	4046	19.4	5056	11.3	4551	15.4
Inoculation— Soybeans grown year before	4046	17.7	4123	13.6	4085	15.7
No Inoculation— Soybeans grown year before	4357	18.2	4356	13.3	4357	15.8

*The plots that had not grown soybeans the year before did have soybeans on them two or three years previously.

gathered easily. The grower could get his planting seed without buying them and a part of the seed could be used as food.

More recently cowpeas have not been very satisfactory in parts of Louisiana, especially in the southern part, due to insect and fungous diseases that frequently attack the crop. It is difficult to combat these troubles. Planting wilt resistant varieties such as Iron and Brabham may help some, but results are frequently unsatisfactory.

LESPEDEZA

Table XXVII. Hay and Seed Yields of Annual Lespedezas

Variety	*Cured Hay Pounds per Acre*				*Seed per Acre—Pounds—1934*
	1932	*1933*	*1934*	*1932-1934 Average*	
Common	5572	3920	6142	5211	156
Tennessee 76	5127	4356	6349	5277	177
Kobe	5853	4283	6643	5593	137
Korean	3812	1742	3986	3180	38

Good yields were obtained from Common, Tenn. 76, and Kobe. Korean does not seem to be adapted to Louisiana. It matures in midsummer, and produces less hay than the other varieties and very few seed. Common produces a high quality of hay and remains green until late fall. The seed germinate later in the spring than Tenn. 76 and Kobe. The plants of Common are hardier than those of the other varieties, thus lessening the danger of being killed by late spring freezes.

If re-seeding is expected, the last cutting in the fall should be made after some of the seeds have matured and shattered, or the cutting should be made early enough to allow the new growth to produce seed.

Annual Lespedezas sown on a firm seedbed during late February or in March at the rate of 25 to 30 pounds per acre have given good results.

Lespedeza sericea. Lespedeza sericea is a perennial species of Lespedeza that is being introduced and tried experimentally in a number of southern states. It is somewhat like alfalfa in appearance and growth habits and can be grown on soils too acid for alfalfa. If the plants are cut at the right time and the hay handled properly, it is similar to alfalfa hay in value. If the cutting is delayed too long, however, the stems become too woody to make good hay, and if the hay is not cured partly in windrows, most of the leaves may be lost in moving it to barn or stack. Another drawback to the use of Lespedeza sericea as a hay plant is the difficulty of getting the young plants started. Unless they are cultivated the first year, grass and weeds may smother them out. This is especially true in parts of the State where the growth of grass and weeds is very rank.

Lespedeza sericea was grown experimentally at the Experiment Station from 1932 to 1936. It was planted in row and broadcast plots and given the following treatments the first year: hand weeded, weeds clipped, and weeds not removed. Weeds and grass were not removed from any of the plots after the first year.

For the first two years, the yield and the quality of hay from both the clipped and the not-weeded plots were comparatively low. In later years the plants on these plots outgrew the weeds and yielded better. Hand weeding is, of course, not a practical procedure in Louisiana.

Two or three cuttings per year were made. It was found that a close cutting late in the season had a tendency to kill many of the plants.

Table XXVIII shows the hay yields for a three-year period. It will be noted that the hay yields on all the plots were low the first year and rather low on some of them the second year. Except in regions where alfalfa cannot be grown, it seems doubtful that Lespedeza sericea will be a desirable crop.

Table XXVIII. Hay Yields of Lespedeza Sericea

Treatment	*1933 Tons per Acre*	*1934 Tons per Acre*	*1935 Tons per Acre*	*3 Year Average Tons per Acre*
L. sericea in drills— weeds removed by hand	2.1	5.9	3.8	3.9
L. sericea in drills— weeds not removed	.24	.88	2.6	1.2
L. sericea in drills— weeds clipped	.34	1.4	2.9	1.5
L. sericea broadcast— weeds removed by hand	2.0	6.6	5.4	4.7
L. sericea broadcast— weeds not removed	.49	1.7	6.3	2.6
L. sericea broadcast weeds clipped	.56	3.7	5.4	3.2

ALFALFA

Excellent crops of alfalfa may be grown on the alluvial lands of south Louisiana and on similar land in other parts of the State. On much of the hill land of the State, however, alfalfa cannot be grown successfully without special soil treatment. In 1930 an experiment was started to determine the effect of certain soil treatments on alfalfa production on the Lintonia bench land soil at Baton Rouge. Hairy Peruvian alfalfa was planted October 6, and duplicate plots used.

Table XXIX gives various treatments used and yields for 1931 and 1932.

PEANUTS

For six years local peanut varieties have been grown in tests in comparison with 32 other varieties and strains introduced into the United States from foreign countries. Some of the new varieties, such as Coinage and San Jose, have produced good yields of both hay and nuts and appear promising under Louisiana conditions. The yields have varied from 2 to 4 tons of hay, with nuts attached, and from 25 to 80 bushels of nuts per acre.

Results indicate that peanuts may be grown profitably as a secondary crop in Louisiana, either for hay and seed or as a pasture crop for hogs.

Table XXIX. Average Yield of Cured Alfalfa Hay per Acre and Treatments Used

Rate of Application Pounds per Acre			Hay—Pounds per Acre 1931	Hay—Pounds per Acre 1932	Average Pounds per Acre 1931-1932	Gain with Phosphate Added—Pounds	Gain with Additional Oyster Shell—Pounds
Ground Oyster Shell	16% Super-Phosphate	Muriate of Potash					
Check	....	....	284	101	193	....	....
....	250	....	226	127	176	....	....
....	500	....	284	313	298	....	....
3000	....	....	3583	5942	4763	....	....
3000	250	....	3986	5923	4954	192	....
3000	500	....	4191	6262	5227	464	....
6000	....	....	4345	6462	5403	....	641
6000	250	....	4634	7010	5822	419	....
6000	500	....	4676	7287	5981	578	....
9000	....	....	4765	7056	5910	....	507
9000	250	....	4426	6946	5686	−225	....
9000	500	....	4316	6448	5382	−528	....
12000	250	....	4451	7636	6093	....	183
3000	....	125	3577	5409	4493	....	....
9000	250	125	4536	7593	6064	....	....

SORGHUMS

The sorghums fall into two groups, the grain sorghums which are grown principally for their grain, and the sweet sorghums or sorgos that have a smaller head of grain but much saccharine matter in the stalk, and heavier weight of stalks.

Date of planting and variety tests with sorghum have been conducted at Baton Rouge, St. Joseph, and Calhoun. The yields from various dates of planting depend largely upon the weather of the particular season. Sorghum will make good growth in Louisiana if planted after June 1. It can be planted much later than corn, and on land poorly adapted to corn. It is probable that sorghum might profitably replace some of the corn planted for feed in North Louisiana.

The best yielding sweet sorghums in the tests were Honey, Kansas Orange, Sapling (Saccaline), and Colman. Sumac and Red or Black Amber are earlier varieties. The best yielding grain sorghums were Shrock (Sagrain), Kafir, Hegari, Chiltex, Feterita, Milo, and Darso. Chiltex and Hegari were the earliest varieties grown.

FORAGE AND WINTER COVER CROPS

Winter cover crops should be planted early in the fall, to allow the plants time to develop a good root system before the winter freezes. Young tender plants with poorly developed root systems are more likely to be killed by occasional low temperatures.

In the winter crops test at Baton Rouge, 6 grasses, 17 clovers, 7 vetches, Austrian Winter Peas, and Tangier Peas have been grown to secure a comparison of their values as winter cover crops. The forage yields were obtained in the spring at the approximate time each crop should be turned under before a succeeding crop is planted. The green weight was taken for each crop and a 5-pound green sample was cured and weighed for a basis to calculate the cured forage per acre. Table XXX gives the yield in pounds of cured forage per acre of the various crops grown.

TABLE XXX. FORAGE AND WINTER COVER CROPS TEST

Variety	*Cured Hay Pounds per Acre*				
	1932	*1933*	*1934*	*1936*	*Average for Years Grown*
Orchard Grass	....	3703	....	....	....
Red-top Grass	....	3519	....	....	....
Dallis Grass	3521	1862	....	....	2691
Centipede Grass	5853	....	....	....	....
Italian Rye Grass	2311	....	....	....	....
Canary Grass—Reed	....	7351	....	....	....
Southern Bur Clover	....	4911	....	4206	4558
California Bur Clover	....	....	....	6256	....
Tifton Bur Clover	....	5826	6011	5429	5755
McNeill Clover (Cluster)	....	5824	4043	....	4933
Manganese Clover	....	....	....	3496	....
Persian Clover	....	2906	6330	3692	4307
Crimson Clover	....	....	6125	5489	5807
Alsike Clover	3528	6365	4029	4280	4551
Ladino Clover	....	....	3839	3275	3557
White Clover	4593	4451	2891	3071	3752
Subterranean Clover	....	3839	4530	5897	4755
Tri. procumbens (Hop Clover)	....	4955	3893	....	4424
Tri. dubium (Hop Clover)	....	2515	3594	....	3054
Cluster Clover	....	....	1203	....	....
Mammoth Red Clover	5772	9293	....	....	7533
Black Medic	3631	3308	4329	2951	3555
Melilotus indica	....	....	3389	1531	2460
Austrian Winter Peas	....	2777	5401	2951	3709
Tangier Peas	3659	4288	4612	3872	4108
Hungarian Vetch	2975	2001*	5227	3016	3305
Hairy Vetch	....	3398	4996	3928	4081
Smooth Vetch	3255	3237*	5513	3868	3968
Common Oregon Vetch	2513	2071*	5268	3880	3433
Purple Vetch	3588	2882*	6583	4189	4313
Monantha Vetch	2294	2115*	4212	4515	3285
Wooly-pod Vetch	2776	1899*	6708	3030	3603

*1932 Dry weights were used to figure weight of cured hay.

Considerable variation occurred from year to year. Vetches are best suited for winter cover crops, but the results do not indicate that any one variety is best for all conditions. Some of the higher yielding varieties in South Louisiana are often killed in North Louisiana by occasional low temperatures.

Vetches that produce 2 to 3 tons of dry matter per acre add 150 to 200 pounds of nitrogen to the soil when turned under.

Hairy vetch is winter hardy and probably the most dependable of the vetches; however, it may grow very little during the winter and growth is slow during early spring. Wooly-pod vetch is closely related to Hairy, but not so winter hardy, and produces more growth during the winter and early spring. Hungarian vetch is subject to winter freezing, but is thought to be better adapted to wet, poorly drained soils than other vetches. Smooth and Purple vetches produced high yields but are not usually considered sufficiently winter hardy for general use.

Austrian Winter Peas, Tangier Peas, and some of the clovers have given very good results as winter cover crops, but are more sensitive to acid soils than the vetches. Tangier Peas produced the highest yields, but they are very susceptible to winter freezes. Austrian Winter Peas are most resistant to low temperatures and are grown very successfully in North Louisiana.

MISCELLANEOUS FORAGE AND GREEN MANURE CROPS

In addition to the work on the forage and soil improvement crops discussed above, a limited amount of experimental work has been done on Crotalaria and some other crops in which there was some interest.

Crotalaria. Crotalaria is an annual summer legume that is grown considerably in Florida and some other states for soil improvement. It has very little, if any, value as a forage crop. Two species are said to be of some value as feed but mules on the Experiment Station farm refused to eat them even when confined in a box stall for a day with nothing else to eat. Some species are considered poisonous to livestock.

Nine species of Crotalaria were grown in tests at Baton Rouge one or more years. All species were rather leafy, but varied a great deal in their type of growth. The species range from 2 to 15 feet in height. Crotalaria spectabilis produced more growth than any other species and seems to be the best for soil improvement. This species produced a five-year average of 21.8 tons of green matter per acre, which, according to analysis, added an average of 169 pounds of nitrogen to the soil when turned under

FIGURE 5. DIFFERENT SPECIES OF CROTALARIA. THE PLANTS WHERE THE MAN IS STANDING ARE CROTALARIA SPECTABILIS.

each year. The species striata and incana produced an average of 12.9 tons and 13.8 tons of green matter per acre, respectively, and when turned under, striata added 142 pounds and incana added 125 pounds of nitrogen. Other species grown were retusa, intermedia, maxillaris, grantiana, anagyroides, and goreensis. These varieties when turned under added from 48 to 109 pounds of nitrogen per acre.

Beggarweed. Beggarweed is a tall-growing annual legume grown to a limited extent for hay and soil improvement on some of the sandy lands of the coastal plain. The average yield on bench land at Baton Rouge for a three-year period was 14.7 tons of green matter per acre. This had a nitrogen content of 102 pounds per acre.

Velvet Beans. The Osceola velvet bean, one of the larger varieties, produced a three-year average yield of 17.1 tons of green matter per acre. This contained 212 pounds of nitrogen.

Sesbania (Coffee-weed). Sesbania, or Sesban, is a weed common on bottom lands in the extreme South. It makes a fairly heavy growth and contains about the same percentage of nitrogen as beggarweed. The yield on bench land was 14.7 tons of green matter per acre with a nitrogen content of 101 pounds.

Teosinte. Teosinte is a coarse annual grass that grows to a height of 8 to 12 feet. It is closely related to corn and will cross with it. It produces many stems from the same roots and can be cut for forage two times during the season. The forage has a feeding value similar to sorghum. The average yield on bench land at Baton Rouge for a three-year period was 28.7 tons of green matter per acre. Seed of Teosinte are scarce and expensive.

OATS

Variety tests with oats were conducted each year from 1931 to 1934 at Baton Rouge and at Calhoun, and in 1931 and 1932 at St. Joseph. These tests give information on the comparative yielding ability of the varieties when grown in different sections of the State. The highest yields were produced by the Red Rustproof varieties, such as Red Rustproof C. I. 1079, Thompson's Red Rustproof, Appler, Hastings 100 Bushels, and by the Fulghum strains. The Fulghum strains are 7 to 10 days earlier than the Red Rustproof varieties, but their yields are usually lower.

Conditions were very favorable for oats in 1931 and high yields were produced at the central station at Baton Rouge and at each of the branch stations. In 1931 the leading varieties produced 75 to 85 bushels per acre at Calhoun, 85 to 90 bushels at Baton Rouge, and 90 to 100 bushels at St. Joseph. Conditions, however, were much less favorable in 1932, 1933, and 1934, and the average yield was 10 to 20 bushels per acre both at Baton Rouge and at St. Joseph. These low yields were due principally to the crown rust disease. The rust diseases are more severe in South Louisiana than in the northern part of the State. Fair yields were produced at Calhoun each year. The Red Rustproof varieties planted there produced a four-year average of 50 to 58 bushels per acre.

The Red Rustproof varieties are rust resistant but they are not "rustproof." These varieties possess sufficient resistance to produce fair yields when the rust diseases are not very severe. The disease was so severe in 1932, 1933, and 1934 that oat production was unprofitable in South Louisiana with the varieties being grown.

The Experiment Station discontinued the oat variety test after 1934 and began a more extensive breeding program to develop varieties more resistant to the rust diseases. A good variety must be resistant to winter freezes and have the ability to produce high yields, in addition to being resistant to rust. The U. S. Department of Agriculture has introduced from other countries many varieties that are highly resistant to rust. These varieties are crossed with the higher yielding varieties of this country and selections are made for higher producing rust resistant strains. In co-operation with the U. S. Department of Agriculture, the Louisiana Experiment Station is testing a large number of these varieties and hybrid selections and making further selections in an effort to develop higher yielding, cold resistant, and rust resistant varieties adapted to Louisiana conditions. It seems that some progress has been made. At present the Country Common, Victoria, Bond, and Alber appear most promising. These varieties, however, are susceptible to freezing. Alber has produced a three-year average yield of 59.8 bushels per acre on bench land at Baton Rouge.

GROWING RICE ON DRY LAND

Some farmers that live in areas where the fields cannot be flooded conveniently are interested in growing a small amount of rice for home use. In 1932, in co-operation with Mr. Jenkins of the Rice Experiment Station at Crowley, a planting was made on bench land at Baton Rouge to test the feasibility of growing rice without water. The

TABLE XXXI. DRY LAND RICE VARIETY TEST

Variety	*Method of Planting*	*Width of Row—Feet*	*Yield of Rough Rice, Pounds per Acre*			*Average*		
						on Beds		*in Furrows*
			1932	*1933*	*1934*	*4-ft. Rows*	*2-ft. Rows*	*2-ft. Rows*
	on beds	4	479.2	827.6	620.7	643	....	....
	on beds	2	893.0	1698.8	1306.8	....	1300	....
Honduras	in furrows	2	718.7	1764.2	1089.0	....	....	1191
	on beds	4	141.6	1100.0	239.6	494	....	....
	on beds	2	283.1	1761.2	326.7	....	791	....
Fortuna	in furrows	2	217.8	1764.2	283.1	....	....	755
	on beds	4	468.3	1132.6	903.9	835	....	....
	on beds	2	936.5	1786.0	1502.8	....	1408	....
Vintula	in furrows	2	588.1	1611.7	1176.1	....	....	1125
	on beds	4	283.2	555.4	664.3	501	....	....
	on beds	2	522.7	1459.3	1263.2	....	1082	....
Delitus	in furrows	2	609.8	1807.7	1219.7	....	....	1212
	on beds	4	305.0	827.6	631.6	588	....	....
	on beds	2	479.2	1372.1	1372.1	....	1075	....
Wataribune	in furrows	2	392.0	1350.4	1219.7	....	....	987
	on beds	4	......	653.4	773.2	713	....	....
	on beds	2	......	1197.9	1197.9	....	1198	....
Edith	in furrows	2	.....	1306.8	849.4	....	....	1078
	on beds	4	.....	1045.4	1023.7	1035	....	....
	on beds	2	.....	1720.6	1067.2	....	1394	....
Shoemed	in furrows	2	.....	2069.1	958.3	....	....	1514

varieties named in the following table were planted on beds and in furrows in 2-foot and 4-foot rows, and cultivated enough to keep down grass and weeds. The planting dates were May 5, 1932, April 18, 1933, and April 26, 1934.

The yields given in Table XXXI show that a good crop of rice may be made without flooding, if given cultivation. The quality of the rice produced equalled that of rice grown under irrigation at Crowley.

SUNFLOWERS

Sunflowers were grown on both alluvial land and bench land at Baton Rouge in 1932 and 1933 to study their value as a crop for oil production. Two varieties were grown: Mammoth Russian and one designated as "Cuba."

The seeds were planted May 12, 1932, and April 19, 1933, in hills 12 inches apart in rows 4 feet apart. Later plants were thinned to one plant per hill. One head per plant was permitted to grow. Plants received the usual cultivation that corn is given.

The heads were cut when mature and threshed by hand to obtain the seed yields. On alluvial land, Mammoth Russian and Cuba produced an average of 49.1 bushels and 32.5 bushels per acre, respectively. Lower yields were secured on bench land.

Seeds of both varieties contain 11.0 per cent oil, by the cold press extraction method, based on weight of entire seed.

Yields were apparently reduced by insect damage, chiefly by one of the wood borers, *Hippopsis lemniscata*. The entire stalk was tunneled by the larvae, thereby stunting the growth of the plant, preventing normal development of the head, and causing the stalks to break off or lodge badly.

The extraction of oil from sunflower seed is an expensive process. For successful operation, a mill requires 60 tons of seed per day. With the development of other plant oil industries, it is doubtful that sunflower production for oil will become a profitable enterprise in Louisiana.

PART IV

F. L. Davis and H. C. Lovett

SOIL FERTILITY AND FERTILIZER INVESTIGATIONS

Cotton, Corn, and Soybean Rotation.

This rotation experiment has not run long enough for the full effects of the different rotations and treatments to show. However, some trends are apparent. There was a steady decrease in yield on land where corn was grown continuously without soybeans or fertilizer; where soybeans were planted with the corn, the level of production was maintained both with and without fertilizer. A winter cover crop of Hairy vetch has increased corn yields consistently, but the margin of increase has not been great. Where corn and soybeans were rotated with cotton, both when fertilized and when unfertilized, the yields of corn were lower than from continuous cropping to corn and soybeans. This is probably due to the fact that the cotton gets the main benefit from the soybeans.

Cotton in a fertilized rotation gives the largest yields; the unfertilized rotation next. The fertilized continuous cropping, the continuous cropping with a winter cover crop, and the continuous cotton without treatment, follow in yields in the order named.

Table XXXII. Cotton, Corn, and Soybean Rotation on Lintonia Silt Loam—Baton Rouge

Plot No.	Crop or Rotation	Fertilizer Treatment†	Yield of Corn—Bushels per Acre					
			1932	1933	1934‡	1935	1936‡	5-Year Average
1*	Corn and soybeans, continuously.........	No fertilizer	29.3	31.7	16.2	48.2	26.5	30.8
3	Corn and soybeans, continuously	Fertilized	51.5	40.8	16.9	61.3	22.4	38.6
5&6	Cotton, corn and soybeans, rotation	No fertilizer	33.0	18.8	14.8	31.5	19.7	23.6
7&8	Cotton, corn and soybean rotation	Fertilized	48.7	29.8	17.0	50.8	24.7	34.2
9	Corn and soybeans with winter cover crop of hairy vetch, continuously	No fertilizer	33.7	34.9	17.6	53.8	22.9	32.6
11	Corn, continuously	No fertilizer	52.6	26.9	11.1	31.6	12.5	26.9
			Yield of Cotton Pounds Seed Cotton per Acre					
2	Cotton, continuously	No fertilizer	620	1117	768	1154	811	894
4	Cotton, continuously	Fertilized	515	1601	803	1661	1055	1126
5&6	Cotton, corn and soybean rotation	No fertilizer	677	1511	889	1747	1073	1179
7&8	Cotton, corn and soybean rotation	Fertilized	648	1708	861	1988	1187	1278
10	Cotton, continuously with winter cover crop of hairy vetch	No fertilizer	744	1427	847	1436	875	1066

*4 Replications or series of each plot.

†All fertilized plots received 600 pounds of a 5-8-4 fertilizer per acre annually.

‡Both corn and cotton were severely damaged by a tropical storm in June, 1934, and by dry weather in 1936.

Winter Cover Crops. In two experiments conducted for several years at Baton Rouge, the value of nine different winter cover crops has been compared to commercial inorganic nitrogen. Adequate quantities of phosphoric acid and potash have been applied annually to the cotton. The results indicate that the profit realized from turning under the various winter legumes before planting cotton is largely determined by the quantity of green matter turned under. In those instances in which the legumes failed to produce a growth of 3 tons or more of green matter per acre at the time of turning, they did not give as profitable increases in the yields of cotton as did applications of 36 pounds per acre of inorganic nitrogen. Austrian Winter peas, Hairy vetch, Hungarian vetch, Oregon-grown Common vetch, and Melilotus indica or "sour clover," have consistently given greater returns than has 36 pounds of mineral nitrogen per acre.

Residual Effect of Leguminous Green Manures. The growth of cotton obtained after plowing under leguminous winter cover crops for two or three consecutive years showed that it was not necessary to grow a green manure crop each year in order to maintain cotton yields at a high level on Lintonia silt loam. Consequently, they were not planted and the residual effects of those previously turned under were studied. The three-year average increase in yield of cotton from turning under vetch or Austrian Winter peas was 625 pounds per acre of seed cotton and from Melilotus indica it was 457 pounds. The application of 36 pounds of mineral nitrogen annually gave an average increase of 456 pounds of seed cotton per acre. In addition to the effect of legumes upon the crops immediately following them, the residue from the Melilotus indica increased the yields of cotton by 377 and 237 pounds of seed cotton per acre, respectively, the two following years. The average increase from the residue of the vetch or Austrian Winter peas amounted to 234 pounds per acre of seed cotton the first year and 190 pounds the second year. There was little or no residual effect from the applications of mineral nitrogen.

Adaptations of Winter Cover Crops. Of the winter legumes included in the tests, Hairy vetch, Hungarian vetch, Oregon vetch, Austrian Winter peas, and Melilotus indica have proved to be best adapted for green manure crops at Baton Rouge. Melilotus indica has been winter-killed once (the winter of 1932-33) since the fall of 1930. Although it has produced fair growth without lime, its response to lime at Baton Rouge shows that it is adapted only to neutral or very slightly acid soils. Liming of acid soils is necessary for successfully growing this crop.

The turning under of rye and oats has not economically increased the yield of cotton. Their value as winter cover crops depends upon their capacity for preventing soil erosion and for providing late winter or early spring grazing for livestock.

Under the conditions of these experiments, neither bur clover nor Persian clover has produced sufficient green organic matter to give maximum increases in yields of cotton.

Effect of the Date of Turning Under Soybeans on the Yield of Corn. Soybeans planted with corn were turned under on October 1, December 1, and March 1. No differences in the yield of corn were obtained as a result of the time of turning under the soybeans. Fall plowing was more effective in ridding the land of trash from crop residues. Incidentally, the test also showed that planting soybeans in the same rows with corn considerably reduces the yield of corn in very dry seasons.

FERTILIZER INVESTIGATIONS

Placement of Fertilizers. The object of this experiment was to determine the effect of the manner and placement of fertilizer in respect to the location of the seed upon the stand and yield of cotton. It was conducted cooperatively on Olivier silt loam at Baton Rouge for five consecutive years, 1931 to 1935, inclusive.

The fertilizer used was a 4-8-4 neutral fertilizer and all placements were made at planting time. They consisted of 14 different placements of the standard rate of application, which was 500 pounds per acre; three placements of one-half the standard rate, or 250 pounds per acre; and three of one and one-half times the standard rate, or

750 pounds per acre. Six replications of each treatment were made, being so divided that 12 stand counts and 12 yield weights could be recorded for each individual treatment.

Early in the season considerable differences in growth existed, but as the plants approached maturity these differences largely disappeared. Small but fairly consistent differences in yield were obtained from the different placements. Some placements definitely affected the stand.

The data indicate that the best results are obtained by placing the fertilizer as near as possible to the seed without seriously affecting the stand. An application of 250 to 500 pounds of fertilizer per acre is best placed in a band 1¾ inches wide located at a depth of from 2 to 3 inches directly below the seed, or 2 to 3 inches below and 1½ inches to the side of the seed; or it may be mixed with the soil to a depth of 3 inches under the seed. Applications as large as 750 pounds per acre are better placed 3 inches below the seed.

The Comparative Efficiency of Nitrogen from Various Sources. When applied with 48 pounds per acre each of phosphoric acid and potash, 30 pounds of nitrogen per acre from the following materials have given the following 10-year average yields of seed cotton on Lintonia silt loam at Baton Rouge: Nitrate of soda-potash, 1360 pounds per acre; nitrate of soda, 1355 pounds; a mixture of nitrate of soda and cottonseed meal, each supplying one-half of the nitrogen, 1309 pounds; a mixture with two-thirds of the nitrogen from nitrate of soda and one-third from sulphate of ammonia, 1294 pounds; calcium nitrate, 1278 pounds; 16-20 "Ammophos," 1239 pounds; Cyanamid, 1230 pounds; urea, 1226 pounds; and sulphate of ammonia, 1210 pounds. The plat not receiving nitrogen yielded 911 pounds of seed cotton per acre and the unfertilized plat, 839 pounds.

In another test on the same soil type in which phosphoric acid and potash were supplied at rates of 48 pounds per acre each, 30 pounds of nitrogen per acre from the following sources produced the following six-year average yields of seed cotton: Arcadian nitrate of soda, 1510 pounds per acre; nitrate of potash, 1480 pounds; Chilean nitrate of soda, 1472 pounds; ammonium nitrate, 1442 pounds; ammoniated superphosphate, 1327 pounds; and 11-48 "Ammophos," 1212 pounds. The plat receiving no nitrogen produced 1002 pounds of seed cotton per acre and the unfertilized plat, 967 pounds.

Source of Phosphorus for Cotton. In a 4-12-8 mixture applied at the rate of 600 pounds per acre at Crowley, various sources of phosphorus have given the following four-year average yields of cotton: basic slag, 1127 pounds of seed cotton per acre; bone meal, 1113 pounds; superphosphate, 1103 pounds; citratus, 1068 pounds; Ruhm's phosphate, 919 pounds; and rock phosphate, 843 pounds. The unfertilized plats yielded 225 pounds of seed cotton per acre and the no-phosphate plats, 244 pounds.

In 1936, the following phosphorus carriers, in applications of 600 pounds per acre of a 6-8-4 fertilizer, gave the following yields of cotton on Granada silt loam at Crowley: bone meal, 1111 pounds of seed cotton per acre; superphosphate, 1101 pounds; calcined phosphate, 1086 pounds; 11-48 "Ammophos," 1076 pounds; basic slag, 997 pounds; ammoniated superphosphate, 973 pounds; and ground raw rock phosphate, 597 pounds. The no-phosphate check plat produced 384 pounds of seed cotton per acre.

Rate of Nitrogen for Corn. On alluvial land at the Baton Rouge Station, each 16-pound increase in the amount of nitrogen applied per acre has given an increased yield of corn. Sixty-four pounds of nitrogen per acre was the largest amount used and has given a two-year average increase of 24 bushels of corn per acre.

*Rate and Time of Applying Nitrate of Soda.** Field tests designed to determine the most profitable rate and date of applying nitrate of soda to corn, cotton, and oats, were conducted by F. A. Mitchell, graduate assistant, and the late Dr. A. H. Meyer, Associate Soil Technologist, at seven locations in the State.

Side application of 200 pounds of nitrate of soda per acre to corn when it was from knee to waist high gave slightly larger yields than did "bedding on" either at planting or two weeks before planting time.

Used with mineral fertilizers, 200 pounds of nitrate of soda per acre "bedded on" at the time of planting gave the most profitable yields of cotton. "Bedding on" two weeks before planting was intermediate and side-dressing the nitrate of soda after planting was the least profitable.

The rate of nitrogen test on oats indicated 200 pounds of nitrate of soda per acre to be, on the average, the most profitable application. From the first of February to the first of March was found to be the best period in which to apply nitrate of soda to oats. It was applied broadcast.

Rate of Potash for Cotton.† Tests designed to determine the most profitable rate of potash fertilization for cotton were conducted at Crowley, Mer Rouge, St. Joseph, Homer, Calhoun, Baton Rouge, and Lacassine. In fertilizer applications of 600 pounds per acre, 6 per cent potash gave the most profitable increases in yields at Crowley, 8 per cent at Homer, Calhoun, and Baton Rouge, and 12 per cent at Lacassine. Inclusion of potash in the fertilizer was not economical on the alluvial soils at either St. Joseph or Mer Rouge. Continuation of the tests for several years at Calhoun and Baton Rouge indicates 24 pounds of potash per acre to be sufficient for cotton when applied regularly each year. The results of the test at Calhoun further showed that applying the potash as a side-dressing gave larger increases in yields than did application at planting on deep sandy soils.

Fertilizer Analysis Tests with Corn. A limited number of fertilizer ratio tests with corn have shown that 30 pounds of nitrogen can in general be expected to give the best returns. Additions of phosphoric acid and potash have not been found profitable for corn.

Fertilizer Analysis Tests with Cotton. The general analysis tests with cotton have given in nearly all cases definite indications as to the fertilizer requirements of the various soils of the State. In these tests all fertilizers were applied before planting.

The tests on the Red and Mississippi river bottom lands have consistently shown that nitrogen is the primary limiting factor in the production of cotton. Thirty to 40 pounds of nitrogen per acre appears to be a satisfactory range in the amount to use, although increased yields have been obtained from as much as 72 pounds per acre at the St. Joseph Station. In these tests the profits from 30 to 40 pounds of nitrogen

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ranged from \$4.00 to \$21.68 per acre or from \$2.33 to \$6.16 per dollar invested in nitrogen. Potash has not been found to be necessary for the production of cotton on these soils, but 24 pounds of phosphoric acid per acre has been fairly definitely indicated as necessary for the largest yields on the older or long-used fields.

The results of tests on the terrace or bench land soils of the Mississippi River have shown that from 30 to 40 pounds of nitrogen per acre gave the largest returns when phosphoric acid and potash were also supplied. All soils on which the tests have been conducted showed a definite need for phosphoric acids but the maximum profits per acre were consistently obtained from 24 pounds per acre. The response to potash varied and the amounts necessary for maximum profits varied from 24 to 48 pounds of potassium per acre. The larger applications of potash tended to be most profitable in seasons when conditions permitted late fruiting.

On the prairie soils of the southwestern part of the State, 24 to 30 pounds of nitrogen per acre have given the largest net profits when phosphoric acid and potash were also supplied. The tests also showed that 48 pounds of phosphoric acid and 48 pounds of potash were necessary for maximum yields. Applications of potash are important as a means of preventing cotton "rust" in this section of the State, and in areas in which cotton "rust" is excessive even larger applications than 48 pounds per acre have been profitable.

Under average conditions, 30 to 36 pounds per acre of nitrogen in the fertilizer have given the maximum net profits in the analysis tests conducted on the interior coastal plain or hill land of northern Louisiana. The tests have shown that cotton does not efficiently utilize the heavier applications of fertilizers on the very sandy soils when subjected to excessive drought. The phosphoric acid requirements of these soils ranged from 24 to 48 pounds per acre; the larger application, on the average, gave the largest returns. The potash required also ranged from 24 to 48 pounds per acre. The deep, sandier soils needed the heavier application.

(More details and recommendations based upon the results of the analysis tests will be published in the near future in bulletins now in preparation.)